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After the success of our first paper edition, it is with great pleasure that we publish our second paper edition of BMJ Case Reports. We have now published over 10 000 online case reports and these excellent reports are a drop in the ocean!

As we enter this new phase, we want to highlight Global Health: improvement in health and access to healthcare for all; and to make sure that all our case reports, clinical or Global Health, include the patient’s perspective. An example of a Global Health case report is included in this booklet, it is an important case about access to healthcare (page 1). We look forward to seeing many more of these - an important contribution to the debate about public health priorities in an era of epidemics, conflict, violence and financial austerity as global medical communities unite to address inequalities in the social determinants of health.

Seema Biswas,
Editor, BMJ Case Reports

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Case Report

Ramifications of poor medical education and screening in minority populations: an extensive acral melanoma

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SUMMARY

After 2 years of holistic self-treatment on his home island, an elderly Samoan man presented with a painful, hyperpigmented mass on his left heel. Physical examination revealed a black, friable tumour with necrotic tissue and superficial ulcerations with no other associated symptoms. Further investigation revealed that the mass was invasive. The tumour was treated with resection and a final diagnosis of acral lentiginous melanoma, stage T4b was made. Poor access to care and screening services are large barriers to care for minorities and patients with low socioeconomic status. Once access is obtained, however, patient compliance is not guaranteed. Healthcare practices often clash with societal beliefs, and so patient education regarding their disease and its possible progression, along with treatment options, is important. Furthermore, a lack of ethnically diverse physicians contributes to low cultural competency during interaction with patients from minorities, resulting in poor communication and low patient satisfaction.

CASE PRESENTATION

An 82-year-old Samoan man, skin phototype V, presented with left heel pain due to a large, exophytic, hyperpigmented, polypoid mass. He had initially presented to the dermatology clinic 2 years previously with a small, dark macule, but had decided to self-medicate holistically on his home island until his heel pain prompted his return. Physical examination revealed a lesion consisting of black, necrotic nodules and friable granulation tissue along with ulcerations and purulent/serosanguinous discharge. At the base of the lesion was a hyperpigmented, asymmetrical macule with nodularity (figure 1). The patient had no other associated symptoms and no lymphadenopathy.

An MRI demonstrated a 9×7 cm lobulated, exophytic left heel soft tissue mass with invasion into the fat pad, but no other tissue invasion or bone erosion. Biopsies from the medial and plantar surfaces of the macular lesion showed marked pigment deposition throughout all levels of the epidermis and in the superficial dermis (figure 2). The histopathological findings also revealed lentiginous proliferation of atypical melanocytes associated with irregular epidermal acanthosis along with prominent pagetoid spread of atypical intraepidermal melanocytes (figure 3). Atypical melanocytes were noted at dermal papillae tips, but it was difficult to discern any definitive invasion into the dermis.

These initial findings suggested a diagnosis of acral lentiginous malignant melanoma in situ with a vertical growth phase resulting in an extensive nodule. Although definitive features of invasive melanoma were not identified, given the patient’s history, the small sample size of tissue, and the lack of biopsies from the fungating mass, it was felt that tumour excision was the most appropriate treatment.

A sentinel node biopsy was negative so a below-the-knee amputation was carried out. Gross examination of the resection revealed clear margins and findings of a variably pigmented (white to black) lesion with a focal area of fungating tumour measuring about 9×7×3 cm. Adjacent to this fungating mass, covering approximately half of the lateral aspect of the foot, was an ill-defined, grey-blue discoloration measuring 11×8 cm. Finally, located 0.4 cm medially from the variably pigmented lesion and grossly separate from the main lesion, was a well-demarcated, slightly firm, black lesion measuring 0.5×0.5×0.2 cm. Microscopic findings of the fungating mass revealed superficial ulceration and an underlying multinodular, heavily pigmented mass with gross extension into the adjacent adipose.
tissue that measured 3.2 cm Breslow depth. Additional histopathological findings of the mass and lesions were consistent with biopsy results and also demonstrated invasion into the dermis and subcutaneous tissues. Midway through the dermis, prominent regression was indicated by tumoural melanosis and fibrosis. Deeper to this, the tumour extended into the subcutaneous tissue without pigmentation, which was supported by findings of marked cytological atypia that included pleomorphism, abnormal chromatin patterns and atypical mitotic figures (figure 4). The mitotic count was 15/mm² with the hot spot method. No definitive lymphovascular invasion or perineural invasion was identified. Acral lentiginous melanoma, stage T4b was the final diagnosis (figure 5).

GLOBAL HEALTH PROBLEM LIST

- Minorities with darker skin tones are at higher risk for acral melanomas.
- Minorities and those with low socioeconomic status (SES) usually present with advanced disease.
- Minorities and those with low SES have decreased access to healthcare due to various barriers.
- Populations with low SES have poor access to secondary preventive medicine.
- Poor diversity among healthcare providers results in decreased cultural competency.

GLOBAL HEALTH PROBLEM ANALYSIS

According to a report from California, Native Hawaiians and Pacific Islanders (NHPI) were one of only two racial groups where the leading cause of death was cancer, with rates above the national average. Acral lentiginous melanomas are the most common form of melanoma (29–72%) in dark-skinned individuals, with a median age of onset of 65, and often result in a higher mortality rate due to misdiagnoses in favour of more common diseases. Minorities with darker skin tones have a higher risk of acral melanoma. Additionally, minorities and those with low SES usually present with thicker lesions and more advanced disease, leading to a higher mortality rate.

Worse health outcomes in low SES populations are likely due to poor secondary prevention, such as low access to skin screening services and lack of patient education on harmful melanocytic lesions. One study found that women and younger patients tend to seek medical screening services more often than men and older individuals. Another study revealed that low SES patients generally know little about their own medical condition, tend to have a high school education or less, and have difficulties arranging transport, all factors contributing to care barriers. Meanwhile, those with a higher SES are generally better educated with more medical knowledge, and are aware that skin changes can indicate cancer. Therefore, patients with higher SES tend to recognise skin changes when they self-screen and obtain medical treatment earlier than lower SES patients.
Our case concerning an elderly man from a remote Pacific island, supports this notion of barriers to care and delayed seeking of care due to lack of understanding and knowledge of disease and the long distances that must be travelled to obtain proper, specialty care. Rural and isolated populations share similar characteristics regarding access to care. Several studies have shown that poor access to care for these populations is mainly due to remoteness, travel time, lack of specialty care, and the cost of obtaining healthcare services, with longer distances correlating with infrequent doctor visits, decreased use of preventive services and fewer routine follow-up visits.1–10

Multiple studies have shown that having a usual source of care (person or place where one receives healthcare) improves access to medical screening services and decreases health disparities; however, this is often not available to minorities.7 11–13 Language proficiency, insurance availability, time away from work, and low income combined with out-of-pocket expenses, and even lack of citizenship, are some of the barriers experienced by minorities that prevent them from having a usual source of care, thus leading to health disparities and poorer overall health.1 14 15

Insurance availability is likely the main barrier. Having health insurance decreases health disparities among high and low SES groups by facilitating access to preventive and primary care while lowering the overall cost.11 15 16 Although many uninsured minorities are eligible for insurance, they often do not sign up for it due to lack of awareness or limited proficiency in English,11 although a Californian study showed high (88%) English proficiency among NHPH.11

Another barrier to care is lack of cultural understanding or competency by the physician. Generally, physicians withhold more clinical information from minority patients, who then often feel excluded from medical decision-making concerning their own care.11 Typically, the ethnicity of physicians does not reflect that of their patients,4 who consequently believe that their physician is unaware of popular cultural alternative/ holistic medicine.11 Perhaps a Samoan provider would have related better to our patient at an earlier point of care and, although understanding his wish to try homeopathic treatment, would have educated him about his advanced disease and need for modern medical treatment, thus leading to a better outcome.

Differences in cultural background and language difficulties can cause a breakdown in physician–patient communication, leading to decreased trust in the physician and poor quality of care due to lack of patient compliance, which results in fewer primary care visits and decreased use of preventive services.11 A diverse and/or engaged healthcare team can build greater cultural competence and provide high-quality care to all patients as there is clearer communication and better patient understanding of their condition and treatment options, which creates trust and increases patient satisfaction.1 11
CASE REPORT

Ischaemic necrosis of the tongue

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SUMMARY

Necrosis of the tongue is a rare clinical finding. The rich vascularity of the tongue means necrosis is uncommon but it has been reported secondary to giant cell arthritis, radiotherapy and ischaemia. We report the case of a 61-year-old man admitted with an acute abdomen, who later developed gross swelling of the tongue, secondary to ischaemic necrosis, which necessitated tracheostomy placement. The ischaemia was managed conservatively with heparinisation and by allowing the ischaemic area to demarcate and slough off naturally.

BACKGROUND

The tongue is a well vascularised end-organ with its primary blood supply from the lingual arteries. For this reason reports of lingual ischaemia and necrosis are rare. The most common cause for this presentation reported is giant cell arteritis (GCA). This, however, is usually unilateral and associated with other features of that pathology. Other reports of lingual necrosis exist secondary to vasoressor use, radiotherapy and antiphospholipid syndrome (APS). Reports of bilateral ischaemia are rare but have been reported in relation to severe hypotension or disseminated intravascular coagulation. We present a case of bilateral lingual ischaemic necrosis presenting in a 61-year-old patient as an acutely swollen tongue threatening the airway.

DIFFERENTIAL DIAGNOSIS

Lingual ischaemia is a rare clinical presentation; in this setting, potential diagnoses to consider are:

- Arterial infarction
- Lingual infarction
- Profound hypotension
- Vasoressor use
- Disseminated intravascular coagulation
- Giant cell arteritis (most common cause but usually unilateral)

TREATMENT

A conservative treatment approach was decided on. This involved continuing with adequate therapeutic heparinisation of the patient as previously started and awaiting demarcation of the ischaemic area. The area was expected to heal by secondary intention.

outcome and follow-up

The ischaemic area later became necrotic before sloughing off the tongue. The patient was discharged from ICU to the ward on day 33 to continue supportive care and at this time a clear demarcation between perfused and ischaemic areas was visible on the tongue.

DISCUSSION

The tongue is well vascularised with its primary blood supply emanating from the lingual arteries. The lingual artery is an end artery of the intrinsic...
muscles of the tongue. It also receives some supply from the facial and pharyngeal arteries. When lingual necrosis presents it is commonly unilateral and related to the vasculitis GCA. Other features of this pathology are usually, though not always, present including a pulsatile temporal artery, jaw claudication and a raised erythrocyte sedimentation rate (ESR).^{1} Cases have been reported where *Ergotamine Tartrate*, used to treat migraine, precipitated lingual necrosis. In these cases, it is believed that headaches may have been misdiagnosed as migraine and not GCA. The vasospastic effects of *Ergotamine Tartrate* may then magnify the effect of the vasculitis, an important consideration when prescribing for elderly patients.

Case reports also exist of other causes of lingual necrosis including vasopressor use, radiotherapy, antiphospholipid syndrome, disseminated intravascular coagulation, fungal infection and secondary to carotid artery stenosis.^{2,4,6,9,10} A case series has also been published recently documenting lingual necrosis secondary to severe hypotension in cardiac shock. All patients in this series suffered end-organ damage, limb ischaemia and lingual necrosis as a result of hypotension and poor peripheral perfusion. In our patient, GCA was an unlikely diagnosis given the chronology of the presentation, its bilateral nature and the absence of other features of the pathology. A biopsy could be considered to support this diagnosis if vasculitis was suspected in tandem with characteristic clinical features and an elevated ESR.^{1} A biopsy and specific antibodies, anticardiolipin and lupus anticoagulant, can also be used to diagnose lingual lesions relating to antiphospholipid syndrome.^{4} A number of other potential causes listed above could also be reasonably excluded. Our patient was severely hypotensive on admission requiring extensive vasopressor use. His lingual necrosis appeared to be temporarily related to the development of other end-organ dysfunction suggesting poor peripheral perfusion or embolic ischaemia as potential causes. The acute swelling may also have suggested possible venous infarction.

The management of lingual necrosis is not well reported but conservative measures are usually adopted. In cases of GCA or APS, it appears that treatment of the underlying pathology also allows for resolution of the lingual necrosis. In the case of GCA this involves high-dose prednisolone once a diagnosis is suspected. Other causes such as APS may require anticoagulant treatment. In previously reported cases of extensive necrosis a conservative approach was adopted, as with our patient. It has also been published recently documenting lingual necrosis secondary to mucormycosis.\(^{11}\) Ultimately, the correlation between extensive lingual necrosis and other severe co-morbidities, resulting in end-organ damage, may highlight a poor overall prognosis.

**Figure 2** Demarcation between perfused and ischaemic lingual tissue.

**Learning points**

- Lingual ischaemia with necrosis is a rare presentation.
- Giant cell arteritis is a common cause of unilateral lingual necrosis.
- In extensive cases other comorbidities may coexist and lingual necrosis may be a sign of poor overall prognosis.

**References**


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CASE REPORT

Resection of a large carotid paraganglioma in Carney-Stratakis syndrome: a multidisciplinary feat

Rebecca Spenser Nicholas, Ayyaz Quddus, Charlotte Topham, Daryll Baker

SUMMARY
A 39-year-old man was referred to the vascular surgeons with a right-sided cervical mass, palpitations, headaches and sweating. He had presented with abdominal discomfort 12 months earlier. Investigations had revealed a gastrointestinal stromal tumour (GIST) and left adrenalecctomy. CT of the neck with contrast demonstrated a large right carotid paraganglioma, extending superiorly from below the carotid bifurcation to encase the internal carotid artery. Genetic screening confirmed the diagnosis of Carney-Stratakis syndrome, an SDH-D germline mutation leading to GIST and multifocal paragangliomas.

Successful surgical excision required considerable multidisciplinary teamwork between neuroendocrinologists, anaesthetists and surgeons. The tumour was highly vascular and involved the right carotid body, hypoglossal and vagus nerves. Access was challenging and maxillofacial surgical expertise were required for division of the mandible. The patient made a good recovery following speech and swallowing rehabilitation.

BACKGROUND
Multidisciplinary teamwork is essential in order to provide the best possible care for our patients. This report describes the management of a man with a rare syndrome that affects multiple organ systems, which required extensive medical and surgical collaboration.

Carney-Stratakis syndrome (CSS) is an autosomal dominant inherited condition comprising multifocal paragangliomas (PGLs) and gastrointestinal stromal tumours (GIST). It is a rare condition with a prevalence of <1/1 000 000, caused by germline mutations in succinate dehydrogenase subunits B, C or D leading to formation of neuroendocrine tumours with oncogenic activity.1 2

We report a case of large carotid PGL in CSS which necessitated extensive preoperative planning and teamwork between multiple disciplines. The tumour position, involvement and vascularity are characteristic of head and neck PGLs.3 Collaboration between neuroendocrine physicians, anaesthetists, vascular and maxillofacial surgeons, and speech and language therapists (SALT) was essential in order to safely resect the tumour and rehabilitate the patient post-operatively. The case demonstrates clearly how teamwork between colleagues from various specialties was integral to achieving safe and effective patient care.

CASE PRESENTATION
A fit-and-well 39-year-old postman, with a family history of lung cancer and hypertension, was referred to the vascular surgeons with a right-sided cervical mass, palpitations, headaches and sweating. He had presented with abdominal discomfort 12 months earlier, and following investigation had been diagnosed with a stomach GIST and left adrenal phaeochromocytoma, which had necessitated left adrenalecctomy.

On examination he was normotensive with a blood pressure of 135/87 mm Hg, heart rate of 60 bpm. Head and neck examination demonstrated the right cervical mass with no palpable lymphadenopathy. General examination was unremarkable.

INVESTIGATIONS
At time of referral to vascular surgery, the patient had already undergone extensive investigations.

Twelve months earlier when he had presented to his local hospital with vague abdominal discomfort, he underwent upper gastrointestinal endoscopy. This revealed a mass arising from the muscularis propria of the lesser curvature of the stomach. Biopsy and immunocytochemistry confirmed this to be a high-grade epithelioid GIST.

Following this diagnosis, contrast-enhanced CT scan of the chest, abdomen and pelvis demonstrated a stomach mass, consistent with the GIST, and a left supra-adrenal PGL. CT of the neck with contrast demonstrated a large right carotid PGL (9×4.5×2.3 cm), extending superiorly from below the carotid bifurcation to encase the internal carotid artery (figure 1). It also showed a small (8 mm) contralateral carotid body PGL located at the level of the second cervical vertebrae.

123I metaiodobenzylguanidine scintigraphy was subsequently conducted, revealing high uptake within the left supra-adrenal PGL. Left adrenalectomy was performed laparoscopically without complication prior to referral to the neuroendocrine team for their specialist opinion on the case.

Blood and urine tests showed raised chromogranin A (66 IU/L; reference range 0–27), raised plasma normetadrenaline (2.20 nmol/L; reference range <1.3 nmol/L), raised 24 h urine normetadrenaline (4.84 nmol; reference range 0–4) and raised 24 h urine 3-methoxytyramine (11.26 nmol; reference range 0–2.5) with normal plasma and 24 h urine metadrenaline levels.

Following neuroendocrine multidisciplinary team (MDT) review, a 68-Ga-DOTA octreotate positron emission tomography scan was performed. This demonstrated high uptake within the GIST tumour,
the bilateral head and neck PGLs, and some additional small nodes of uptake in close proximity to the ascending aorta.

The patient was referred for genetic screening in light of the presence of multiple PGLs and the GIST. This established a diagnosis of CSS in association with an SDH-D germline mutation.

**TREATMENT**

Following discussion between the neuroendocrine, vascular and hepatobiliary MDTs, excision of the right carotid body tumour was deemed to be the treatment priority, given its increasing size and functionality. The GIST tumour would be excised subsequently. The small left carotid PGL had not changed significantly over the past year to warrant any surgical intervention.

Excision of the large right carotid body tumour was performed by an experienced vascular surgeon, though necessitated extensive perioperative planning and teamwork between neuroendocrine physicians, radiologist, anaesthetist, vascular and maxillofacial surgeons. Detailed three-dimensional reconstructions of the head and neck CT scans enabled detailed preoperative surgical planning. Achieving adequate access to the tumour was challenging and required maxillofacial surgical input in order to divide and subsequently reform the mandible. This posed additional challenges for the anaesthetic team regarding how to achieve and maintain a safe airway throughout the procedure. The tumour was highly vascular and involved the right carotid body, hypoglossal and vagus nerves (figure 3). Blood pressure was successfully controlled throughout the 9 h operation despite tumour manipulation. Both nerves were preserved and the mandible was reformed with titanium and screws.

As planned, the patient was admitted to the intensive care unit following surgery and had an uneventful immediate postoperative recovery. Nasogastric feeding was started following surgery and propranolol and doxazosin were initiated to control heart rate and blood pressure, prior to discharge from intensive care 4 days postoperatively.

The patient had a hoarse voice and swallowing difficulties postoperatively, as predicted from the necessary and prolonged manipulation of the vagus and hypoglossal nerves which had been adherent to the tumour. Review by SALT and fibreoptic endoscopic evaluation of swallowing confirmed inadequate swallowing protection, vocal fold abduction and non-clearance of secretions, with the need for long-term rehabilitation.

On the 15th postoperative day the patient was discharged home from hospital, with ongoing support from the community SALT team in place. On outpatient follow-up 3 months post discharge, the patient had ongoing hoarseness and difficulty swallowing, so a percutaneous endoscopic gastrostomy tube was inserted to allow supplementation of his nutritional intake.

**OUTCOME AND FOLLOW-UP**

At 4 months post carotid body tumour resection, the patient was able to return to work as a postman. A year later the patient is now able to swallow and his voice strength has greatly improved.

GIST excision by the hepatobiliary surgical team is being planned as next priority and further therapy with lutetium 177 (177Lu) DOTA octreotate or radionuclide-targeted therapy is being considered by the neuroendocrine physicians to treat the residual disease he has associated with his CSS.

**DISCUSSION**

PGLs are neuroendocrine tumours that can be derived from either the parasympathetic or sympathetic nervous system. They are rare tumours (1/300 000 incidence) that occur most
frequently in men and are usually benign. They typically occur in the second and third decades of life. PGLs can be divided into two broad categories dependant on their anatomical location and autonomic function. Extra-adrenal tumours of the head and neck are characteristically located along the carotid bifurcation in close association with the vagus nerve, middle ear space or in the jugular foramen. PGLs located below the neck characteristically occur within the adrenal medulla (pheochromocytoma), in the upper mediastinum near the aorta, in the organ of Zuckerkandl (chromaffin cells of neural crest origin located along the aorta, most commonly at the inferior mesenteric artery origin or aortic bifurcation), or affecting the paraganglion cells of the urinary bladder. Sympathetic PGLs have a strong tendency to hypersecrete catecholamines (up to 90%) whereas only 5% of parasympathetic PGLs secrete catecholamines.

Up to 35% of PGLs are thought to be hereditary and tumours located at the carotid bifurcation are approximately six times more likely to have a genetic predisposition compared with PGLs located elsewhere. The hereditary syndromes associated with PGLs include Von Hippel Lindau disease, neurofibromatosis type 1, familial PGL syndromes 1–4, multiple endocrine neoplasia type 2 and CSS. Extra-adrenal PGLs are generally associated with a threefold greater risk of metastases compared with adrenal PGLs. Furthermore, there are currently no reliable histological, genetic or radiological markers to predict malignancy of these tumours except for the appearance of distant metastases in lung, liver or bone. Owing to the possibility of metastases and functioning PGL’s, the mainstay of treatment is surgical resection of suspicious tumours that are functioning or enlarging. Even in instances where the tumour is non-functioning, excision is frequently advocated due to the likelihood of compromise of important vascular and neural structures caused by continued growth of the tumour.

Our case demonstrates the importance of a multidisciplinary approach to surgical resection of a large carotid PGL in a patient with CSS. Careful preoperative preparation is imperative for patient safety. The aim of meticulous preoperative planning is not only to plan the surgical approach, but also to prevent potentially life-threatening catecholamine-induced complications that can be caused by tumour manipulation during surgery. These include hypertensive crisis, cardiac arrhythmias, pulmonary oedema and cardiac ischaemia. A thorough anaesthetic assessment with optimisation of blood pressure, heart rate, anti-hypertensive medication and increasing salt and fluid intake in the preoperative period can reduce perioperative mortality to less than 3%.

Carotid body PGLs are more likely to be malignant than adrenal PGLs and are not amenable to laparoscopic resection. Thus open resection is recommended for all large or invasive head and neck PGLs. Cranial nerve injury (most commonly the vagus or hypoglossal nerve) is the most frequent complication following surgical resection of such PGLs. On review of the literature, it is evident that nerve injury is associated with larger tumour size, in keeping with the Shamblin classification system. This emphasises the need for genetic screening in order to pre-empt familial occurrence and aid early diagnosis. Rates of cranial nerve damage are typically 20–30%, with the vast majority being temporary.

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**Figure 3** Images showing preoperative markings, postoperative result and intraoperative images pre-excision and postexcision of tumour.
Multidisciplinary teamwork and safe surgical resection are the cornerstones of current guidance on management of carotid body tumours.13 14 Owing to their multifocal nature, interdisciplinary communication and collaboration is fundamental to the management of patients with neuroendocrine tumours.8

The excision of any carotid body tumour requires a multidisciplinary approach. The additional factors associated with CSS in our patient’s case involved further specialists still (for extensive biochemical and radiological investigations, genetic counselling and diagnosis, prioritisation and planning of the adrenalphaeochromocytoma, carotid body PGL and subsequent GIST excision) and made this case a true multidisciplinary feat. The case serves to highlight the importance of teamwork between colleagues from various specialties and illustrates the centrality of the MDT to achieve safe and effective management of such complex cases.

Multidisciplinary specialist perspectives on case
Endocrinology perspective
“In complex hereditary syndromes the role of the Endocrinologist is to have a low threshold of suspicion and provide accurate interpretation of clinical and laboratory results in order to provide a diagnosis and oversee the management of the patient as a whole. This includes patient and family education, arranging genetic testing and surveillance. In this case, the Neuro-Endocrinology Specialist Team play a lead role in the overall coordination and oversight of the patient’s long term care, though clearly collaboration with multiple other specialties is essential in order to provide the treatment the patient requires.” (Dr. Tabinda Dugal, consultant endocrinologist)

Anaesthetic perspective:
“The role of the multidisciplinary team is vital to ensure a good outcome in these rare and complex cases. We, as anaesthetic perioperative physicians are able to impart knowledge relevant to the peri-operative course. Of particular importance is the pre-operative assessment of risk relating to cardio-respiratory fitness and subsequent optimisation, peri-operative management of the difficult airway and cardiovascular responses to tumour manipulation. Finally the post-operative analgesia, airway and cardiovascular management can be planned. Another vital role we have in the multidisciplinary team is reflection on cases and adaption of future management to maintain world class outcomes.” (Dr Sandi Wylie, consultant anaesthetist)

Speech and language therapy perspective
“The speech and language therapy team works closely with patients postoperatively following carotid body tumour removal, assessing and treating them accordingly. Head and neck surgery to resect extensive tumours, such as in this case, carry the risk of vagus and hypoglossal nerve damage, which affect speech and swallowing. Important factors to note were the extent of nerve involvement in the tumour itself, whether any of the nerves needed to be sacrificed in order to achieve resection, and the length of anaesthesia required for the surgery. We serially assess the patient functionally in terms of vocal strength and safety of swallow, and use imaging techniques such as Fibreoptic Endoscopic Evaluation of Swallow (FEES) in order to assist with diagnosis and prognosis. Postoperatively we work closely with the patient, the surgical team, nurses, dieticians, nutritional nurses, ENT doctors and the community speech and language therapy teams in order to provide the joined-up and holistic care the patient needs to achieve a good recovery.” (Nicola Perkins, speech and language therapist)

Vascular surgical perspective
“This is a complex case which involved careful teamwork between several specialties. In order to perform the surgery safely, it required meticulous preoperative planning and support from my anaesthetic and maxillofacial surgical colleagues intraproeratively. Postoperatively the case required extensive input from the speech and language therapy team, which is essential with any case involving the mandible. Their input was especially relevant in this case due to the inevitable speech and swallowing difficulties that follow the resection of a tumour that is involving the nerves which control speech and swallowing. The management of our patient in this case has demonstrated that the only way of ensuring success is a well-organised multidisciplinary team where every specialist has an important role.” (Mr Daryll Baker, consultant vascular surgeon)

Patient perspective
“I first found out I had a tumour in the stomach. That was a massive shock because I felt fine—the discomfort in my stomach had settled down by the time they did the endoscopy. Then they said they found some kind of tumour in my stomach. You automatically think its cancer and I’m going to die within a couple of months—you mind always goes to the worst case scenario.

They took further biopsies and ran further tests and scans and after about 3 weeks they told me the results. The stomach tumour was a GIST, but they found out I also had an enlarged adrenal gland. I had to have this removed, which seemed like a small operation to me. I took it for granted that it would be fairly easy. In the operation too, which would enable them to open the jaw if they needed to do that to get to the bottom of the tumour—which is what turned out to be necessary. He made me aware of all the risks of nerve damage and everything, and I decided to go through with it. I felt ok up until a day before the operation, when I started to feel nervous. I remember meeting the anaesthetist and both surgeons. They were all fantastic and explained things really well.

When I woke up after the operation I felt fine—I had no pain whatsoever. I thought I was just groggy after the operation. I could speak, but it was nothing compared to my usual voice. It was like having a really bad case of laryngitis. When I heard my own voice it didn’t sound like me! To start with I told myself “it will get better in a couple of days” but then when it took longer it felt like it would be forever and permanent—that I wouldn’t be able to speak normally again. I didn’t know at the time, but when my wife saw me she was in complete shock—She was worried about the neck wound and all the metal staples, as well as my voice. I didn’t see the kids for about 10 days.

I knew that the operation needed to be done and that it had been a success, though I also understood that the tumour had been involving the nerves in my neck that are needed for normal swallowing and speech. Even though they were careful and managed not to cut the nerves, it was inevitable that there was some damage, so after the operation I was unable to eat

Reminder of Important Clinical Lesson
and drink. Because the nerves were preserved I knew things would get better, but they still suffered significant damage, so took quite a while to improve. You don’t realise how long nerves take to recover. The body takes quite a while to repair itself! You always assume that medical people can do a quick intervention and make something better, but there’s no quick fix. It took a full year of speech and language therapy to get back to normal with eating and drinking and I had a PEG fitted to supplement my intake in the meantime. The jaw is still slightly stiff compared to the other side, which I had been told can take 18 months to go back to normal. Even simple things like brushing my teeth was really painful after the operation—that took about 9 months to get better.

I had fantastic support after the operation—speech therapy once per week. And my voice has been getting better and better. They put in an implant to push the vocal cords closer together and since then it’s been even better. My swallowing has improved and things have moved on tremendously. I am still doing voice and swallowing exercises every day for an hour or so. I am really pleased with the scar on the neck—it is fading really well and the colour is lightening and is almost like my normal skin tone now. There is still a slight twinge in my jaw when I eat, but it is nothing severe, especially compared with the shooting pain in the jaw I got straight after the operation. It was difficult to open my jaw before, but I have had a trismus machine to help me stretch the muscles of my jaw to make the opening back to normal again.

I was back to work about 4 months after the operation, which helped a lot. Just being back to a normal routine was great. For my wife and children too, it was great to have a normal routine just like it was before. My family has adjusted really well and it made a massive difference to eat the Christmas meal together as a normal family this year. It’s that kind of stuff you take for granted!

I used to think about the situation over and over, but now it takes up a very small part of my day and I get on as normal. The care I have had has been faultless—it really has been fantastic. When I think about the operation and read up on the internet and realise the amount of structures that run through the base of the skull and the neck and all the things that could have gone wrong, I am just relieved I can move my face—that’s it’s not droopy on one side, my eyes are totally fine, my mouth can move, and speak and swallowing are all getting back to normal. I am really grateful for all the care I’ve had.

I was very aware of the doctors all working together throughout, and still now. They would send me all the notes from the MDT meetings and I always felt involved in all the decisions. At one point I was under about 12 different doctors in four different hospitals because the case was so complex! Before my diagnosis, the only thing I had been to the doctor for was a cold—I hadn’t seen a doctor in years! I used to assume that the one doctor would know everything. Now I know it’s a lot more complicated than that and there are many different specialists who need to be involved and work together."

**Contributors**
Supervised by DB. Patient was under the care of DB. Report was written by RN, AQ and CT.

**Competing interests**
None.

**Patient consent**
Obtained.

**Provenance and peer review**
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**REFERENCES**

Patient self-demonstration of the anterior drawer test in an ACL deficient knee

Prasad Ellanti, Kevin James Mulhall

DESCRIPTION

A 19-year-old male presented with a rupture of the previously reconstructed anterior cruciate ligament (ACL) of his right knee. He had sustained his initial injury 4 years previously while playing soccer and had undergone an ACL reconstruction with an ipsilateral patella tendon graft 2 years previously. He had injured his knee again playing soccer 1 year previously. On examination he was positive for Lachman’s test, the anterior drawer test and the pivot shift test. The patient did not have hyperlax joints and the knee was otherwise stable on examination. Unusually he was able to self-demonstrate the anterior drawer test with translation of the tibia anteriorly from the normal position (figure 1 and video 1). We believe that contraction of the gastrocnemius muscle (superficial posterior compartment) pushes the tibia anteriorly, while contraction of extensor hallucis longus and extensor digitorum muscles (anterior compartment) pulls the tibia anteriorly on the fixed foot. This combined action seems to produce the observed anterior tibial translation. The tibia reduces to its normal position with relaxation of these muscles and brief contraction of the hamstring muscles, namely the semimembranosus, semitendinosus and biceps femoris. The quadriceps muscle remained inactive throughout this abnormal motion. No other significant internal derangement of the knee was noted on arthroscopy before revision reconstruction of the ACL using ipsilateral hamstring tendon grafts was undertaken. The incidence of rupture of a reconstructed ACL can be up to 12%; however, the risk of rupture after 1 year is the same as for the contralateral ACL.1

Figure 1

Clinical photograph showing self-demonstration of the anterior drawer test; the two black arrows show translation of the tibia anteriorly (B) from the normal position (A).

Video 1

Video showing self-demonstration of the anterior drawer test.
Learning points

▸ The primary function of the ACL is to prevent anterior translation of the tibia. It acts as a secondary stabilizer against internal rotation of the tibia and valgus angulation at the knee.
▸ Lachman’s test, the anterior drawer test and the pivot shift test are the most common clinical tests used to assess cruciate ligament instability.
▸ The incidence of rupture of a reconstructed anterior cruciate ligament (ACL) can be up to 12%; however, the risk of rupture after 1 year is the same as for the contralateral ACL.

Contributors PE examined the patient and KJM treated the patient. Both authors wrote the manuscript and approved it for publication.
Competing interests None.
Patient consent Obtained.
Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCE
CASE REPORT

Fatal Waterhouse-Friderichsen syndrome due to Serotype C Neisseria meningitidis in a young HIV negative MSM (men who have sex with men).

Abhinav Agrawal,1 Sarfaraz Jasdanwala,1 Abhishek Agarwal,2 Margaret Eng1

SUMMARY

Waterhouse-Friderichsen syndrome (fulminant meningococcaemia) is a fulminating infection, often leading to mortality in a matter of hours. In the past 3 years there has been a rise in cases of Neisseria meningitidis in the men who have sex with men (MSM) population in the USA and sporadic cases over the world especially in those who are HIV positive. We describe a case of a 34-year-old Caucasian man who presented with acute fulminant meningococcaemia, which proved fatal over a period of hours. This case report emphasises the need for further vigilance, prompt diagnosis and treatment of fulminant meningococcaemia without signs of meningitis especially in the MSM population and the need to expand vaccination recommendations of Meningococcaemia in the MSM population across the USA in both HIV positive and negative males.

CASE PRESENTATION

A 34-year-old Caucasian homosexual man presented to the emergency room with the c/c of pain in upper and lower limbs, nausea, vomiting and generalised weakness of 1-day duration. The patient had 10 episodes of vomiting. No fevers or chills. He also had petechial rashes on the upper and lower limbs. He was alert and oriented when he presented to the emergency room, but soon became lethargic and had to be intubated. The patient’s blood pressure started dropping and the patient soon became critical with massive haemorrhage and hypotension. The patient had 10 episodes of vomiting. No fevers or chills. He also had petechial rashes on the upper and lower limbs. He was alert and oriented when he presented to the emergency room, but soon became lethargic and had to be intubated. The patient’s blood pressure started dropping and the patient soon became critical with massive haemorrhage and hypotension.

The patient’s white cell count on admission was 7600/mm3 with a platelet count of 34 000/mm3. His serum bicarbonate level was 9. His blood work showed International Normalised Ratio of 2.5, fibrinogen of 76 mg/dL which pointed towards fulminant disseminated intravascular coagulation (DIC). Blood cultures were drawn. As his course worsened, his arterial blood gas showed a pH of 6.83.

The patient was given broad spectrum antibiotics including vancomycin, meropenem, fluconazole and doxycycline and also received one dose of ceftriaxone. He was subsequently admitted to the intensive care unit and was given fluids and vasopressors. He was also given three units of fresh frozen plasma, one unit of platelets, 10 bags of cryoprecipitate and 5 mg of intravenous vitamin K. During the course of the night he became bradycardic and went into asystole and then resuscitative measures were undertaken. The patient did not respond to the resuscitative measures and eventually died.

The blood cultures that were drawn in the emergency room grew Neisseria meningitidis Serogroup C within 24 h. The autopsy report obtained from the medical examiner’s office showed disseminated coagulopathy with purpuric skin rash and petechial haemorrhage with haemorrhagic adrenal glands. Microscopic examination of the brain did not show acute or chronic meningitis. Microscopic examination of the adrenals revealed acute haemorrhage consistent with Waterhouse-Friderichsen syndrome related to fulminant meningococcaemia.

GLOBAL HEALTH PROBLEM LIST

▸ N. meningitidis causing meningitis and Waterhouse-Friderichsen syndrome in the MSM (men who have sex with men) subgroup of the population.

GLOBAL HEALTH PROBLEM ANALYSIS

There is a recent rise in the incidence of meningococcal meningitis due to N. meningitidis in the USA in the MSM population. Most cases are seen in HIV positive males and present with classic signs of meningitis along with disseminated meningococcaemia. It is important to note that HIV negative patients of the MSM population are at an equally high risk of infection with N. meningitidis. Also cases may present just as Waterhouse-Friderichsen syndrome without any signs of meningitis and thus it is necessary to recognise this high-risk population and the symptomatology of Waterhouse-Friderichsen syndrome with appropriate intervention as the disease progresses over a matter of hours. While the state of New York has come up with directives for vaccination of this new high-risk group, there is a need to expand the vaccination directives to other places and also in the MSM population who are HIV negative.

N. meningitidis is the second most common cause of community-acquired adult bacterial meningitis. The typical initial presentation of meningitis due to N. meningitidis consists of the sudden onset of fever, nausea, vomiting, headache, decreased ability to concentrate, and myalgias in an otherwise healthy patient. Fulminant meningococcaemia (Waterhouse-Friderichsen syndrome) is one of the most devastating manifestations of N. meningitidis. It tends to strike young, previously well individuals and progresses over a matter of hours to death. Between
2005 and 2011, the incidence of meningococcal disease in the USA was 0.3 cases per 100 000.4

In the fall of 2012, an outbreak of meningococcal disease was detected in MSM in New York City, with 22 reported cases between 2010 and March 2013 of which 12 occurred in HIV-infected individuals and 7 cases were fatal.1 In 2013 three cases of invasive meningococcal disease were reported in Germany, three cases in France and one case in Belgium.8 In our case, a 34-year-old MSM, HIV negative male presented with fulminant meningococcaemia (Waterhouse-Friderichsen syndrome) with acute onset of symptoms without any signs of meningitis with fatal progression of the disease within a matter of hours despite treatment. Fulminant meningococcal disease may present with initial symptoms such as leg pain, cold hands and feet, rash and may quickly progress to shock, DIC and purpura fulminans. This deadly infection can be seen in crowded environments such as dormitories, boarding schools and kindergartens. Military barracks is also one of these environments. Turhan et al9 reported two young male recruits who were diagnosed with meningococcaemia and meningitis due to \textit{N. meningitidis} W135 even after being vaccinated with bivalent (A/C) meningococcal vaccine previously. Therefore quadrivalent \textit{N. meningitidis} vaccination application is really important for individuals under risk such as military personnel, students staying on college and university campuses or at a bar.2 There is a need to expand these guidelines outside the state of New York as more cases are appearing in other parts of the USA and worldwide.

Contributors All the authors were involved in the discussion. Abhinav Agrawal contributed in the management of the patient and writing of the case report. SJ participated in the management of the patient. Abhishek Agrawal reviewed current guidelines. ME performed reviewing of the manuscript and gave expert opinion.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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CASE REPORT

Hemipelvectomy images of loss caused by war

Tal Salamon,1,2 Shokrey Kassis,3 Alexander Lerner4,5

SUMMARY
As we treat our 230th patient from the Syrian conflict, the pathology we see is more debilitating and the humanitarian needs of the wounded have become even more obvious. This case presents some graphic images of the realities of war. Care in the most advanced units cannot restore broken limbs, let alone broken lives. We present a case of a young war-injured man who suffered severe crush injury to the pelvis and lower limb, arriving at our medical facility after a delay of hours. The lower limb was shattered from the pelvis down (essentially a traumatic hemipelvectomy). His life had been saved in Syria by ligation of the femoral vessels in an unknown facility by an unknown medical team. On arrival in a centre in Israel for definitive care of an unsalvageable leg, formal hemipelvectomy was performed.

BACKGROUND
The border between Israel and Syria has officially remained closed since the last Arab-Israeli war in 1973. There is a demilitarised zone between the two countries monitored by United Nations forces. The two countries are considered enemy states with no official diplomatic relations. In spite of this, casualties of the Syrian civil war continue to find their way to the border where they are met by Israeli Defence Force medical teams, stabilised and then transferred to Israeli district hospitals for further treatment. Among the wounded are soldiers, civilians, women and children. Further information about their background or homes is neither known, requested, nor disclosed.

Some patients have been treated within Syria and may occasionally present with Syrian medical documentation. Many, however, have had no treatment or rudimentary care to stop major haemorrhage on their way to Israel. It is not known whether this care is provided within medical facilities by trained staff or whether emergent care is delivered by well-meaning individuals who find themselves caring for patients with life-threatening injuries. What is clear, however, is that care is improvised, and in instances has permitted patients with severe injuries to survive as far as the border. From there they are transferred to Israel for definitive care.

This case highlights three important points relevant to modern war surgery. First, patients are receiving care in neighbouring countries not at war and where advanced healthcare services are available. Second, war surgery is not simply trauma surgery—the delay in patient transfer for definitive care means that they are in advanced stages of sepsis. Third, after 4 years of civil war, malnutrition is a huge factor in physiological well-being at the time of injury and convalescence.

CASE PRESENTATION
A 20-year-old man wounded in the Syrian civil war was brought to the emergency room of an Israeli district hospital by the Israeli Defence Force ambulance service, approximately 6 h after massive trauma in Syria. Exact details of the injury are unknown. The left lower limb and pelvis were crushed, possibly run over by a vehicle, although the exact mechanism of injury remains unclear.

Details of treatment and transfer within Syria are not known but within Israel he was transported by road 60 km from the Israel-Syria border, an approximately 1 h drive by ambulance, under the care of a military paramedic and military physician. In the ambulance he received 2 L of normal saline (0.9%) and 2 units of O–ve blood (packed cells). On arrival (figures 1 and 2) he was conscious; the pulse rate was 80 bpm and blood pressure 112/92 mm Hg.

There was no evidence of head, neck, upper limb or chest and abdominal injury. External pelvic stabilisation was in situ (an improvised blanket).

INVESTIGATIONS
On examination, the left pelvis was crushed and unstable, with an open wound extending anteromedially from the inguinal region, through the medial thigh and scrotum, and posteriorly, a few centimetres from the anus. Left lateral rotation of the thigh revealed a fractured and dislocated pubic bone with a dislocated femoral head lying in the upper thigh. The thigh and calf were crushed and swollen. The thigh muscles were detached and formed an oval mass under the skin. The knee and dorsal foot had become degloved (figure 3).

On vascular assessment, the common iliac vessels were found to be ligated en bloc, probably in the field by a Syrian surgical team; this undoubtedly saved the patient’s life. The leg was pale and cold with mottled skin and no evidence of capillary filling. Neurologically, there was no sensation or movement in the toes, calf or thigh. The anal sphincters were intact and rigid sigmoidoscopy revealed no injury.

A urinary catheter was already in place. There was no haematuria and no clinical evidence of urinary tract injury.

CT angiogram was performed to confirm the absence of injury to the rest of the body (figures 4 and 5) and confirmed a crushed pelvis, fractured iliac bone and dislocation of the sacroiliac joint. The acetabulum and femoral head were displaced caudally—lying in the thigh. No blood flow or
bleeding below common iliac artery was evident in arterial or late venous phases.

TREATMENT
With clinical intent to save the limb, the patient was transferred to the operating room and the inguinal and pelvic wounds opened and explored. There was discontinuity of all soft tissues distal to the peritoneum; the leg was effectively suspended on a segment of dorsal soft tissue and torn obturator vessels and nerves. As the lower limb was unsalvageable, the decision was taken to perform hemipelvectomy (figure 6). The amputation was completed with muscular flap closure from the thigh to the inguino-scrotal-anal skin, and a defunctioning loop colostomy was constructed (figure 7).

Postoperatively the patient continued intravenous antibiotics (Amikacin and Metronidazole—an empirical regimen developed for all casualties from Syria as there has been widespread antimicrobial resistance), nutritional support and returned multiple times to theatre for debridement and lavage of the amputation stump and wounds. Split skin graft was then performed to cover the stump 5 weeks from amputation.

He has received social and psychological support and 3 months later is able to transfer from bed to chair. He mobilised with a prosthetic leg for the first time over 3 months after initial surgery. His discharge is planned but follow-up and continued rehabilitation remain considerable challenges and of great concern to the hospital staff.

DISCUSSION
Traumatic hemipelvectomy (hindquarter amputation) is a severe injury associated with a high rate of morbidity and mortality. Improvedprehospital resuscitation and efficient transfer time1–8 achieves better survival rates but little is known about the emergency medical and surgical services available within Syria at the moment.

Traumatic hemipelvectomy is a rare injury—0.6% of all pelvic fractures8 and aggressive and efficient resuscitation is mandatory for survival. Without ligation of the common iliac vessels in the field of conflict, it is unlikely that this patient would have survived. Unlike many other Syrian wounded, he presented within hours of injury (some patients with severe injuries may take up to 5 days to reach the border). This short delay to definitive care
was also crucial to his survival. McLean was the first to report a case of hemipelvectomy in 1962. Since then there have been at least 70 cases reported in the literature. Although the exact mechanism of injury in this patient is not known and close questioning of the Syrian wounded is discouraged, it is likely that he was run over and possibly dragged some distance by a motor vehicle, in common with the most common causes of this injury—motor vehicle accidents where the pelvis is crushed (run over) or where the leg is caught while the body is dragged in the opposite direction with considerable force (which may also occur in industrial accidents). The morbidity from this catastrophic amputation is usually due to associated intestinal, genital and intraperitoneal injury; and, salvage surgery is usually complicated by flap necrosis and extensive soft tissue infection. Damage control surgery and intestinal diversion (colostomy) decrease the risk of septic complications and improve outcome.

With rehabilitation, this patient might be able to mobilise with a prosthesis, albeit, with difficulty initially, in view of the position of the colostomy. After discharge, it is unlikely that he will have specialist follow-up within Syria. Follow-up is of huge concern to the medical teams involved in his treatment. He is likely to encounter difficulties caring for the colostomy, and this should be closed as soon as the stump is healed and he is able to manage personal hygiene. The prosthesis will also need readjustment. Dedicated psychosocial support is paramount but follow-up in Israel is dependent entirely on his risking the journey to Israel once again. To mitigate this, discharge is with detailed instructions in English, but information sharing, even

**Learning points**

- Early ligation of the femoral vessels in the field saved the patient’s life.
- Early transfer for definitive care may improve clinical course and outcome.
- Mutilating surgery is never an easy decision, but is sometimes necessary to save a patient’s life.
among medical staff, engenders huge risks to individual patients. Staying in Israel for continued care is an option the patients are not prepared to entertain, even though this would be provided for free, as they want to return as soon as possible to their families struggling in Syria, and for whom they are desperately anxious.

He is one of many young men, too young to have lost a limb in conflict but he is, indeed, a remarkable survivor.

Contributors All authors contributed equally to the manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

CASE REPORT

Miracle baby: managing extremely preterm birth in rural Uganda

Hannah Katherine Mitchell,1 Rhianne Thomas,2 Michael Hogan,1 Carolin Bresges1

SUMMARY
Preterm birth is an important cause of neonatal morbidity and mortality globally. Uganda has one of the highest rates of preterm birth in East Africa but few resources to care for these infants. This case highlights the clinical course of an extremely premature infant born at 26 weeks gestation to a nulliparous 24-year-old woman. Her mother was involved in her care and taught the principles of kangaroo mother care. After initial problems establishing feeds she progressed well and was discharged in the fifth week of life. The case describes some of the low technology conservative and medical measures which can be used to care for neonates, such as antenatal steroids and kangaroo care. The use of antibiotics and aminophylline are also discussed. The approach to the common challenges faced by premature infants such as respiratory disease, sepsis and necrotising enterocolitis in a resource-poor environment are discussed.

CASE PRESENTATION
A 24-year-old primigravida with no known significant medical history and no specific risk factors for preterm birth was admitted to the maternity unit of a hospital in Uganda with a 2-day history of labour-like pain. Her membranes had ruptured 2 days previously. She was admitted to the ward for observation and given three doses of oral dexamethasone.

On examination her os was 7 cm dilated. One day later she gave birth to a live female infant by spontaneous vaginal delivery. The baby was born in a poor condition with an Apgar score of 2 at birth and 4 at 3 min. She was given inflation breaths, began to breathe spontaneously and her condition quickly improved.

According to the mother’s last menstrual period, the pregnancy was dated at 26 weeks. The baby was scored according to the expanded New Ballard Score1 for neuromuscular and physical parameters. A total score of 5 (figure 1) correlated with the mother’s menstruation dates and our estimated gestation date of 26 weeks, making the neonate extremely premature.

Respiratory support facilities at the unit were limited with no capacity for ventilation and no surfactant available. The infant was given oxygen via nasal cannulas from an oxygen concentrator maintaining saturations between 88% and 92%. Prophylactic aminophylline was given to decrease the risk of apnoea. The baby fortunately remained stable from a respiratory point of view.

According to the hospital guidelines, premature babies are given 5 days of prophylactic ampicillin and gentamicin. The baby had an umbilical catheter inserted using aseptic technique which provided good intravenous access for the first 10 days of life.

As an extremely preterm and very low birth weight infant, the baby was at risk of developing necrotising enterocolitis. She was kept nil by mouth for the first 48 h and was maintained on intravenous fluids. On the third day of life the baby was started on 1 mL expressed breast milk every 2 h via nasogastric tube. The feeds were increased by 1 mL every other feed provided that aspirates were minimal. The neonate’s observations were monitored, with stool and urine output recorded on a chart. The milk volume was increased very slowly as there were a number of episodes of abdominal distention. Nevertheless the baby was on full oral feeds by day 14 of life.

Throughout the baby’s time in the unit her mother was kept up to date and involved in her care. Temperature maintenance was initially problematic. The baby’s mother was taught about kangaroo care and encouraged to attend the unit as frequently as possible to provide care. Kangaroo care proved an effective method of stabilising the neonate’s temperature.

When the baby was on full oral feeds she was moved to the ‘kangaroo room’ (figure 2) a warm room where the baby and mother were able to stay together. She was examined daily and her temperature monitored.

The baby was discharged from the unit in the fifth week of life, earlier than desired due to maternal financial constraints. The mother was well educated in the care of her preterm baby and was confident giving the oral aminophylline. She was advised of the symptoms which should prompt her to seek medical attention. The mother and infant returned for weekly weights and examinations until the child was 40 weeks corrected gestational age.

GLOBAL HEALTH PROBLEM LIST
- Preterm birth rates are rising globally, no where more so than in the developing world. Uganda has one of the highest preterm birth rates in East Africa.
- Preterm birth is one of the biggest risk factors for neonatal morbidity and mortality. Multiple complications are associated with preterm birth.
- There is a lack of high-tech medical equipment and medication.
- There is a good evidence base for low-tech and medical interventions but due to lack of knowledge these are often not implemented.
Techniques in the management of preterm birth in the developed world have undergone significant advances, with outcomes for neonates born prematurely improving greatly over the past few decades. However, these advances have not reached the developing world where access to high-tech equipment and drugs is extremely limited.

In 2005, the WHO estimated that globally 9.6% of births are preterm. Preterm infants are disproportionately over-represented in neonatal mortality rates with estimates showing that a quarter of perinatal deaths are attributable to complications of prematurity.

Conservative and medical measures are often the only steps possible in a resource-poor environment. There are a number of pharmacological approaches which have shown demonstrable improvement in neonatal outcomes.

Administration of antenatal steroids to mothers going into preterm labour is routine practice in the developed world. Conversely, in the developing world they are often omitted. Strong evidence exists for the role of antenatal steroids in reducing the incidence of respiratory distress syndrome, intraventricular haemorrhage, periventricular leukomalacia and necrotising enterocolitis in premature infants. Even incomplete courses of antenatal steroids have been shown to give some benefits to extremely premature infants.

The importance of antenatal steroids cannot be overstated. They are generally widely available, easy to administer, even in the community, and have minimal risk of adverse effects to mother and baby. A recent study...
estimated that 500,000 neonatal lives could be saved annually if antenatal steroids were given appropriately to all mothers going into preterm labour.\(^6\)

Another pharmacological agent used to attempt to counteract some of the problems of prematurity is aminophylline. This drug has been shown to reduce the incidence of idiopathic apnoea in premature infants.\(^10\) Owing to controversy regarding the use of aminophylline, caffeine is generally the preferred option in neonatal units in the UK.\(^11\) In this hospital, however, caffeine was not available from the pharmacy. The long-term risk of neurodevelopmental disability associated with aminophylline administration needs to be taken into account. However in the context of providing medical care where respiratory support for these infants is not possible, aminophylline often represents the only available intervention.

Use of prophylactic antibiotics is controversial and guidelines for our institution recommend 5 days of prophylactic ampicillin and gentamicin for all newborn infants. Evidence suggests that prophylactic antibiotics can reduce incidence of necrotising enterocolitis in low birthweight infants,\(^12\) however the issue is fraught with difficulty with challenges of antibiotic resistance and antibiotic side effects.

In preterm prolonged rupture of membranes there is some evidence for giving antibiotics to the mother antenatally as this has been shown to prevent 4\% of deaths due to complications of prematurity and 8\% of deaths due to infection.\(^7\)

There are a number of conservative steps that can be taken in the management of preterm infants which can influence their outcomes. Poor weight gain, dehydration and hypothermia are problems particularly faced by preterm infants. There are challenges of attitudes and awareness both among parents and medical staff; all too often the assumption is made that the infant would not survive and few resources are dedicated to neonatal care.\(^14\) Education of parents is paramount.

In low birthweight infants necrotising enterocolitis is a serious and often fatal problem. Feeding of mother’s milk has been shown to significantly reduce the risk of necrotising enterocolitis compared with formula feeding.\(^15\) Monitoring for excessive or blood or bile-stained aspirates from the nasogastric tube can give indications that necrotising enterocolitis is starting to develop.\(^16\) Feeding poses particular challenges in the community setting as nasogastric tubes may not be available and extremely premature infants are unable to breast feed effectively and risk dehydration. Other methods of feeding may need to be found.

‘Kangaroo mother care’ (KMC) has been estimated to reduce neonatal mortality and morbidity, particularly from infection.\(^17\) In KMC the infant is tied to the front of the mother with a cloth. Skin to skin contact helps to maintain temperature and the mother may be able to recognise earlier when the infant is developing complications so a response can be started. KMC can be a useful tool for mother and baby in conventional neonatal care setting as well as being easily implemented in a community care setting. There is some evidence to support its use when more advanced care facilities are absent.\(^18\) KMC is particularly relevant in the context of hospital care where infants remain in cots without heating facilities and become susceptible to hypothermia which is a significant problem potentially resulting in infant mortality.\(^19\)\(^20\)

The most basic practices such as good cord care, feeding and temperature control represent some of the most important elements and all too often these fundamentals are overlooked.\(^21\)

**Learning points**

▸ Antenatal steroids should always be given to mothers anticipating preterm delivery.
▸ When gestational age is in doubt the New Ballard Score is a validated method of estimating maturity of the neonate.
▸ Caffeine/aminophylline can help to reduce incidence of apnoea.
▸ Kangaroo care can be done in all contexts and has demonstrable benefits.

**Patient’s perspective**

The baby was clinically stable on discharge from our unit. Initially, she returned for weekly weights and examinations and was growing well. When she was discharged from the follow-up of our unit her mother would continue to bring her back to talk to the nurses and midwives and other mothers at the unit.
Global health

Parental involvement and maternal education regarding best practice in caring for their infants is of paramount importance.

There are particular challenges in caring for neonates in the developing world. Without the extensive array of equipment we have come to expect in the developed world, expectations can be low and there can be a reluctance to invest energy in caring for these infants. However as this report shows whether in hospital or the community there are still a number of steps that can be taken to help save the lives of these tiny infants.

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Contributors

HKM was involved in conception and design, drafting and revising the article, editing and final approval of submitted version. RT was involved in conception and design, drafting the article. CB was involved in conception and design, drafting and editing the article. MH was involved in conception and design, drafting the article. CB was involved in conception and design, drafting and editing the article. MH was involved in conception and design, drafting and editing the article. CB was involved in conception and design, drafting and editing the article.

Competing interests

None.

Patient consent

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Provenance and peer review

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REFERENCES

CASE REPORT

Think global, act local: chronic dysuria and sterile pyuria in an Eritrean-American woman

Rachel Lena Rutishauser,¹ Charles Langelier,¹ Sanjiv M Baxi,¹,2,3 Douglas Hanks,³,⁴ Peter Chin-Hong¹,²

SUMMARY
A 70-year-old female Eritrean immigrant living in the USA presented with classic findings of genitourinary (GU) tuberculosis (TB), including risk of tuberculosis exposure based on country of origin, chronic urinary tract symptoms and persistent sterile pyuria despite antibacterial therapy. Furthermore, this patient had the hallmark radiographical findings of ureteral stricture, a dilated pelvic calyceal system, hydrourteronephrosis and bladder wall thickening, as well as a bladder wall biopsy that revealed granulomatous disease. The patient was evaluated multiple times over the course of 3 years in outpatient and inpatient medical settings before a diagnosis was made and appropriate treatment initiated. As with many cases of GU TB, a protracted diagnosis allowed for advanced disease progression and significant morbidity from obstructive uropathy and chronic kidney disease.

BACKGROUND
Because of its protean presentation and frequent mimicry of other common genitourinary (GU) pathologies, GU tuberculosis (TB) is often an under-recognised diagnosis. This is perhaps most significant in developed countries where active pulmonary TB prevalence has declined markedly and new medical trainees may not have the experience to recognise diagnostic features of extrapulmonary disease. Underdiagnosis may be further compounded by the fact that the populations at highest risk for TB within these countries, including immigrants, the marginally housed, immunocompromised patients and prison inmates, are often medically underserved. Furthermore, clinicians may not realise that worldwide the GU tract is the second most common organ system impacted by disseminated TB. Thus, in order to limit potentially severe morbidity, it is important for medical providers to recognise the classic characteristics of GU TB.

CASE PRESENTATION
A 70-year-old Eritrean woman initially presented to an outpatient clinic with dysuria, haematuria and chills. The patient immigrated to the USA in 2001 and returns to Eritrea regularly to visit family. She never smoked tobacco, drank alcohol or used any illicit substances. She lives with her daughter and grandchild. No other family members have acute or chronic medical illness and there are no animals in their home. Urinalysis obtained at her initial visit demonstrated more than 50 red blood cells per high power field (HPF), more than 50 white cell count/HPF and a positive leucocyte esterase. The general practitioner made a presumptive diagnosis of uncomplicated cystitis and started the patient on empiric antibiotic treatment with oral cephalexin. Her urine culture ultimately returned negative.

The patient’s symptoms persisted and she received multiple courses of oral and intravenous antimicrobials for presumed recurrent bacterial urinary tract infections. Notably, urinalyses obtained at each visit demonstrated haematuria, pyuria and proteinuria but urine cultures continually returned negative. Over the course of 3 years, the patient had a total of 17 negative urine cultures documented in her medical record. Cytological examination of specimens from voided urine and bladder irrigation demonstrated atypical cells with mixed inflammation but no malignancy. After a thoughtful review of her disease course and social history, it became evident that the combination of an appropriate exposure (East African origin), chronic progressive lower urinary tract symptoms and persistent sterile pyuria despite antimicrobial therapy constituted features concerning GU TB. Acid-fast bacilli (AFB) culture of her urine was performed, and ultimately all four samples returned positive for Mycobacterium tuberculosis.

INVESTIGATIONS
In the three years prior to her diagnosis, our patient underwent several radiographical and urological studies. Abdominal ultrasound was performed first and showed bilateral left greater than right hydronephrosis, left calicestasis and bladder wall thickening. CT of the abdomen and pelvis subsequently confirmed bladder wall thickening, moderate left hydrourteronephrosis and diffuse ureteral enhancement with an enlarged left retroperitoneal lymph node (figure 1A,B). This was followed by a left retrograde pyelogram that demonstrated a moderately dilated left pelvic calyeal system with a long segment stricture of the distal left ureter (figure 1C). Cystoscopy and ureteroscopy revealed an abnormal non-papillary ureterohium and friable bladder epithelium. Biopsy of the bladder wall showed mixed acute and chronic inflammation with non-necrotising granulomas (figure 2) that stained negative for AFB. Notably, the patient’s chest X-ray demonstrated clear lungs with no nodules or cavitory lesions.

The radiographical findings in GU TB directly reflect the underlying infectious pathophysiology (figure 3). Because of the intrinsically slow disease...
progression and delays in diagnosis, the radiographical findings are variable and highly dependent on the extent of organ involvement. Intravenous urography and abdominal and pelvic CT scanning are the most frequently employed imaging techniques, although ultrasound findings characteristic of GU TB in the correct setting have also been described.\(^1\)

CT and intravenous urography findings typically seen in GU TB include: irregularity of the caliceal outline due to necrotising papillitis (described as ‘moth-eaten’, often an early finding), thickening of the collecting system, calcification of the urinary tract, stenosis-related dilation of the collecting system with hydrocalycosis/nephrosis and/or hydroureter, renal masses, parenchymal atrophy and bladder contraction.\(^{1,5}\) In particular, the presence of multiple ureteral strictures is a pathognomonic finding in GU TB, and a single stricture with at least one of the findings listed above (as seen in the patient described here) or evidence of autonephrectomy plus one other imaging finding except stricture can be seen in more than 94% of intravenous urography and CT studies.\(^6\) Ultrasound can also be utilised for GU TB evaluation; however, this method is less sensitive and specific and typically not recommended.

Microbiological evaluation of GU TB is usually initiated (as in the case of this patient) because of a patient’s epidemiological risk factors combined with multiple, non-specific urinary symptoms and otherwise unexplained findings (including sterile pyuria). AFB stains are commonly utilised as an initial diagnostic modality. Modified Ziehl-Nielsen or auramine-rhodamine staining for AFB on centrifuged urine cells can be performed in less than 1 h; however, this method lacks sufficient sensitivity and requires \(10^3\)–\(10^6\) bacilli/mL of urine for a positive test. AFB culture of at least three early morning (complete first void) urine samples is the diagnostic modality of choice, requires \(10^3\) fewer bacilli/mL compared with staining and has a specificity of 100%. Unfortunately, sensitivity is variable, ranging between 10% and 80%, and is highly dependent on disease severity and sample preparation technique.\(^7–12\) Furthermore, AFB cultures may take up to 8 weeks to become positive. If the patient has taken fluoroquinolones for treatment of presumed bacterial urinary tract infections (UTIs), this may also delay GU TB diagnosis given the antituberculous activity of fluoroquinolone antibiotics. In the case presented here, the patient’s diagnosis was initially confirmed after four out of four first void urine AFB cultures returned positive, the first after just 15 days of culture.

Nucleic acid amplification tests (NAATs) are becoming more frequently available and offer a rapid molecular method to complement culture and stain-based diagnostic techniques.\(^9\) NAATs can be performed on any sample substrate and target several sequences unique to \(M\) \textit{tuberculosis}. Sensitivities for NAATs in urine range from 87% to 100%, with specificities of 92–99.8%.

**Figure 1** CT of the abdomen and pelvis (A and B) demonstrating moderate left hydroureteronephrosis (arrow 1) and a thickened bladder wall (arrow 2). Left retrograde pyelogram (C) demonstrating a moderately dilated left pelvic calyceal system with a long stricture of the distal left ureter.

**Figure 2** H&E stains at \(\times 40\) magnification depicting caseating (A) and non-caseating (B) granulomas identified in tissue from bladder wall biopsy. GMS stain revealed no acid-fast bacilli.
Importantly, this methodology allows one to detect genes or specific mutations conferring drug resistance to common first-line anti-TB chemotherapies. Limiting factors for NAATs include false negatives due to amplification inhibition by urinary enzymes and false positives in patients undergoing active therapy despite effective treatment response.

Microbiological diagnosis can also be obtained by renal biopsy of granulomatous lesions. Histiocytes and granulomas are commonly observed on pathological examination of fine-needle aspirate preparations. While stain and culture of tissue biopsy is highly specific, it is compromised by poor sensitivity, estimated at only 18% to 45% (as demonstrated by the fact that this patient had negative AFB staining of her bladder biopsy samples). Moreover, the culture of biopsied material offers no time advantage over urine AFB culture and may confer significantly greater morbidity from the sample collection. The majority of the value of biopsy is related to the exclusion of malignancy.

Despite an encouraging, albeit modest, decline in the global prevalence of TB over the past century, the emergence of multidrug-resistant-TB has become a major public health concern, with the rate of resistant cases doubling in the past two years in countries with the highest TB burdens. Because of this, obtaining drug susceptibilities prior to initiation of treatment is highly beneficial in endemic areas with known resistance.

Differential Diagnosis
This patient presented with chronic sterile pyuria despite repeat treatment with broad spectrum antibiotics. In many cases, partially treated bacterial UTIs can result in sterile pyuria as can improper clean-catch sampling of midstream micrurition. Other non-infectious intrinsic renal causes of sterile pyuria include papillary necrosis (eg, obstructive uropathy, diabetic nephropathy) and tubulointerstitial diseases (eg, interstitial nephritis, lupus nephritis). GU structural abnormalities causing sterile pyuria include polycystic kidney disease, vesicourethral reflux, nephro/urolithiasis, hydrenephrosis and urinary catheters.

Nephrotoxic medications are a notable cause of sterile pyuria, and common inciting agents include non-steroidal anti-inflammatory drugs (NSAIDs), cyclophosphamide, steroids and indinavir. Notable systemic conditions that may lead to sterile pyuria include severe hypertension, sarcoidosis, systemic lupus erythematosus, pregnancy and malignancies including renal and bladder carcinomas. Infectious causes of sterile pyuria include fastidious organisms such as Ureaplasma urealyticum, sexually transmitted infections (Chlamydia trachomatis, Neisseria gonorrhoea, Trichomonas vaginalis, herpes simplex virus), parasitic infections (Schistosoma haematobium), and in men, prostatitis and balanitis. Finally, uncommon bacterial infections, in particular those due to M. tuberculosis, are an important cause of persistent sterile pyuria and require a fair amount of clinical suspicion to make the diagnosis.

To help differentiate the potential aetiologies of sterile pyuria in this patient, the following studies had previously been sent and returned negative: urine cytology, bladder epithelial biopsy (negative for malignancy) and anti-Schistosoma antibodies. After reviewing the results of our patient’s prior testing and imaging, and considering her risk factors for TB exposure, sending urinary AFB cultures to evaluate for GU TB was the most reasonable step.

Treatment
Pathogen eradication in GU TB lacking drug-resistance mutations is based on the standard first-line treatment regimen utilised for active pulmonary disease and recommended by the WHO. This regimen incorporates an initiation phase with 2 months of rifampicin, isoniazid, pyrazinamide and ethambutol, dose-adjusted for renal function and body mass, followed by a 4-month maintenance phase of rifampicin and isoniazid. Different agents and potentially longer treatment are required if MDR TB or extensively drug resistant (XDR) TB is present or if intolerance due to side effects occurs. Isoniazid resistance is estimated to occur in 10% of all TB cases worldwide. Resistance to more than one agent is also increasing at an alarming rate, and
accounts for 3.7% of infections worldwide. More than 60% of these cases occur in just three countries: China, Russia and India. PCR-based testing is being increasingly utilised to allow for early detection of MDR strains by rapidly identifying genes and discrete point mutations that confer drug resistance.

Treatment of TB in HIV-positive individuals also requires careful consideration. Co-infection of TB with other pathogens combined with impaired cellular immunity may result in protracted disease recovery. Furthermore, the clinician should be aware of paradoxical symptom exacerbation resulting from immune reconstitution inflammatory syndrome in patients with AIDS undergoing simultaneous antiretroviral and antitubercular therapy. The treatment course of GU TB may also be complicated by medication-induced nephrotoxicity. In addition to the well-known hepatotoxicity of antitubercular therapy, rifampicin alone can induce tubular and interstitial injury resulting in acute renal failure, glucosuria and nephrogenic diabetes insipidus. In patients with extensive renal complications, surgical procedures can augment medical therapies and also allow for functional restoration of damaged organs. Abscesses that fail to resolve with pharmacological intervention alone can be drained surgically. In patients with problematic hydrenephrosis, percutaneous nephrostomy, stenting, endoscopy or balloon dilation may be utilised to relieve obstruction. Nephrectomy is indicated when the disease course has resulted in severe hypertension, is accompanied by malignancy or chronic pain, or in the event of site-specific disease recurrence. In severe cases, anastomotic procedures or reconstructions of the ureters, bladder and genitals may be performed. With improvements in anti-tubercular chemotherapeutics and mycobacterial diagnostics, surgical interventions are less common now compared with prior decades.

OUTCOME AND FOLLOW-UP
By the time of treatment initiation, the patient’s previously mild lower urinary symptoms progressively worsened and became complicated by gross haematuria, urge incontinence and polyuria. Fortunately, resistance testing confirmed a pan-susceptible organism. The patient’s treatment was intermittently interrupted and consequently protracted due to medication-related nausea and emesis requiring multiple adjustments of her pharmacological regimen. Her ureteral strictures worsened, leading to severe hydrenephrosis, acute kidney injury and ultimately stage three chronic kidney disease (CKD). She was subsequently admitted to the hospital for hyperkalemia associated with electrocardiogram (ECG) abnormalities, as well as haematuria. She received bilateral J stent placement to compensate for her ureteral strictures and is currently undergoing outpatient management by a nephrologist and a urologist. Presently, her most notable residual symptom is urinary frequency and incontinence secondary to a contracted bladder (estimated capacity of 50 milliliters). Fortunately, a tolerable treatment regimen was eventually identified and follow-up AFB urine cultures after four months of therapy returned negative, confirming successful microbiological control of her infection.

DISCUSSION
Epidemiology of GU TB
TB is a major cause of morbidity and mortality worldwide, with more than eight million new infections each year and over one-third of the world population being currently infected with the disease. This results in two million annual deaths from severe infections, a number second only to HIV/AIDS in terms of global infection-related mortality. The highest prevalence of TB exists in developing countries, including India, China, Russia, eastern Europe, southeast Asia and much of Africa. In the USA in 2011, a total of 10.528 cases of newly diagnosed TB were reported (rate of 3.4 cases/100 000 persons). The prevalence among foreign-born persons is approximately 11.5 times higher when compared with US-born persons (17.2 vs 1.5 cases/100 000). Worldwide, extrapulmonary disease is seen in 4.5–47.9% of primary TB cases, and of these GU involvement is found in 40% of instances. An evaluation of extrapulmonary TB cases in the USA between 1993 and 2006 found that GU TB cases constituted only 6.5% of the reported extrapulmonary cases, with similar findings in surveillance reports from EU countries. Given the fact that making a diagnosis of GU TB is challenging, these numbers most likely vastly underestimate the true number of such cases. In general, the prevalence of extrapulmonary disease is higher in populations with compromised immune function and may be found in up to 50% of HIV-positive patients with pulmonary TB. Extrapulmonary TB is also more prevalent in other patient groups with impaired cellular immunity, including solid organ transplant recipients, patients receiving immune-modulating agents and those with end-stage renal disease (ESRD) on haemodialysis.

Pathophysiology and clinical presentation of GU TB
GU TB is characterised by non-specific symptoms and clinical findings that can mimic other GU pathologies (figure 3). Lower abdominal pain, urinary frequency, haematuria and/or pyuria may be mistaken for common cystitis, and patients rarely demonstrate the fevers or systemic symptoms classically seen in pulmonary TB. Because of this, patient symptoms are frequently attributed to other disease processes resulting in a delayed GU TB diagnosis and unnecessary morbidity including irreversible kidney damage.

In two-thirds of cases, GU TB is a result of reactivation after resolution of primary pulmonary mycobacterial infection; however, it can also present as a feature of primary disseminated TB. In both instances, organisms spread from the lungs to the kidneys via haematogenous dissemination, with subsequent involvement of the ureters and bladder through descending infection of the collecting system and genital organs. As in this patient, reactivation of latent TB may occur many years after primary infection and most patients have no pulmonary symptoms. Furthermore, at the time of diagnosis of GU TB, only one in three patients have abnormal chest X-ray findings. CKD and ESRD can progress insidiously and complicate an estimated 20–50% and 5–20% of GU TB cases, respectively.

In many instances, inflammatory damage and granuloma formation lead to papillary necrosis, ulceration of the calyces, calcification and eventual destruction of the renal parenchyma. An obstructive uropathy can also occur due to ureteral localisation of infection and associated inflammation, fibrosis, strictured formation and hydrenephrosis. Inflammation-induced ischaemia results in activation of the renin-angiotensin cascade, which can induce refractory hypertension that in severe cases may require nephrectomy for treatment. Inflammatory changes may also affect the bladder, eroding the urothelium and inducing fibrosis, decreased bladder capacity, and incontinence. GU TB can also impact the reproductive organs and cause irreversible damage leading to infertility in men and women. In men, GU TB can result in infertility, urethritis, prostatitis and epididymitis. Almost 50% of men present with clinical abnormalities in the scrotum such as a palpable mass, bearing of the
spermatic cord, scrotal wall thickening or a moderate hydrocele. Severe reproductive organ disease is most common in female patients and may present with fulminant symptoms resembling pelvic inflammatory disease or manifest with more generic findings including chronic pelvic pain and dysmenorrhea long after infection clearance. In some countries, GU TB may account for 1% of postmenopausal uterine bleeding and 60–94% of infertility, making this disease a leading consideration during evaluation for reproductive difficulty in certain regions. Even after treatment, less than 10% of births in patients with diagnosed GU TB are successful. Timely diagnosis and appropriate consideration of this underappreciated and often insidious TB manifestation will prevent significant unnecessary morbidity worldwide.

**Learning points**

- There are more than eight million new tuberculosis (TB) infections each year and over two million annual deaths from disease complications.
- Disseminated TB may occur in more than one-third of cases and the organs of the genitourinary (GU) tract are the second most common location of extrapulmonary TB worldwide.
- GU TB has a non-specific presentation and frequently mimics other more common GU pathology, which often delays diagnosis and results in progression to advanced disease.
- GU TB most frequently involves the kidneys, which become infected via haematogenous spread; common clinical findings include chronic dysuria, haematuria and persistent sterile pyuria; complications of GU TB may include chronic kidney disease, hypertension, chronic pain and infertility.
- Diagnostics: CT and intravenous pyelogram may demonstrate classic radiographic findings of GU TB, which include ureteral stricture, a dilated pelvic calyceal system, hydrouretonephrosis and bladder wall thickening. Sending three separate complete volume first void morning urine samples for acid-fast bacilli culture or nucleic acid amplification testing is the most sensitive diagnostic test and should be combined with imaging.
- Treatment of GU TB typically involves the same antibiotic regimen utilised for pulmonary infections, with attention to modifying treatment based on the drug resistance pattern of the TB strain isolated. Greater than 50% of cases will require surgery for reconstruction of a scarred collecting system, drainage of an abscess or hydrenephrosis, or complete removal of an infiltrated kidney.

**COMPETING INTERESTS**

None.

**PATIENT CONSENT**

Obtained.

**PROVENANCE AND PEER REVIEW**

Not commissioned; externally peer reviewed.

**REFERENCES**


Reminder of important clinical lesson

CASE REPORT

The role of palliative rehabilitation in the preservation of personhood at the end of life

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SUMMARY
Progressive advancements in the fields of medicine, oncology and palliative care have seen significant gains in the life expectancy but have also resulted in patients living longer with the burdens of cancer. It is within the sphere of end-of-life care that the role of palliative rehabilitation comes into its own in addressing the effects of increased physical and psychological morbidity that accompany many of these prognostic gains. Focusing on the cancer journey, we highlight the impact of rehabilitative measures on efforts to preserve the personhood of a patient with metastatic renal cell carcinoma and thus maintain her dignity and quality of life and provide her with appropriate and effective holistic care at the end of life. Through employing the Ring Theory of Personhood, the critical role of the complementary aspects of palliative rehabilitation in end-of-life care is brought to the fore.

BACKGROUND
The success of palliative rehabilitation in the preservation of quality of life of terminally ill patients through the maintenance of individual control and mobility even in the face of progressive disease has led to this treatment modality being embraced by many palliative care teams.1–3 Palliative rehabilitation, which Dietz defines as being focused on “assist[ing] in symptom control in progressive disease and in its advanced stages” and in “prevent [ing] or minimizing associated complications and optimiz[ing] quality of life” has also a significant impact on the maintenance of dignity and the provision of holistic care underpinned by its influence on the preservation of the personhood of these patients.4–13 However before we begin to discuss these elements, a clear understanding of the concept of personhood and how it is conceived within the Ring Theory of Personhood (Ring Theory); is required.4–13

While the definition of personhood has until recently been poorly delineated, its role within the maintenance of dignity, quality of life and provision of holistic care at the end of life has well established.5–13 This is particularly evident in palliative rehabilitation.4–13 We utilise the Ring Theory, the first clinically evidenced formulation to define personhood within the palliative care setting, to highlight the impact of rehabilitative measures on personhood and thus its influence in the maintenance of dignity, quality of life and the provision of holistic care at the end of life.5–13

Conceptions of personhood among terminally ill patients
Employing Krishna’s Ring Theory to highlight the importance placed on functionality and the ability to maintain familial bonds and obligations underpins the advocacy of rehabilitative medicine within the palliative care setting.8–13 Briefly the Ring Theory evidences that oncology and palliative care patients see themselves as more than solely reflections of their familial identity, their divine connections with God or their ability to manifest conscious function.6–13 Instead according to the Ring Theory, personhood is made up of four interrelated domains that are illustrated in the form of four rings5–11 (Figure 1).

The innermost ring is called the innate ring. The innate ring embodies the belief that personhood begins from the moment of conception. Innate personhood is formed by virtue of the patient’s ties with the divine or by reason of their genetic or their physical human characteristics.8–11

Highlighting the inherent inter-relatedness of the four rings within the Ring Theory is the belief that those who have close personal and important relationships with the patient endow innate personhood. At the start of life, these are ties with one’s parents.8–11

Encapsulating the innate ring is the individual ring that pivots on the patient’s ability to maintain conscious function. This includes self-awareness, self-control, communication, cognition, interaction with one’s environment and a sense of time, past and future. The individual ring confers on the patient the ability to maintain his or her own personhood. Sustaining one’s own personhood begins with the onset of competence and autonomous function. If however the patient becomes incompetent and or essentially not autonomous, personhood reverts to being endowed by those that share close relationships with the patient and who are aware of their values, beliefs, views and goals. This contingency ensures that the now incompetent patient’s personhood is maintained in a manner that is most akin to their own conceptions of personhood and specific identity and not defined solely on their sociocultural, religious or familial roles, ties and obligations.

The pivotal relationships that are relied on to define an incompetent’s personhood are housed in the relational ring, which encapsulates the individual ring. Here it is critical to state that for the competent and autonomous patient, these relationships need not be solely defined by the presence of familial ties and can often include close friends and
Myth exploded

**Figure 1** The Ring Theory of Personhood.

sometimes even paid carers. It is the patient who determines which relationships are to be housed in their own relational ring.

Another important facet of the relational ring is the entwined nature or the ‘reciprocity’ of these ties. Here individuals whose relationships with the patient are housed in the patient’s relational ring also have their relationship with the patient in their own relational rings. This ‘reciprocity’ creates entwined interests in preserving the patient’s personhood in a manner that is consistent with the patient’s own views and reputation given that any dishonour affecting the patient will also affect those who share a reciprocal relationship with the patient. This concept of reciprocity owes much to Confucian and other family centric perspectives of personhood.8–11

Defining how those within the relational ring conduct and support the patient in their periods of incompetence is the societal ring. The societal ring contains the professional, legal and institutional standards of care and community, religious and cultural beliefs of the society in which the patient is in. This last ring ensures that even when there are no family members present, the patient is cared for in a manner that is consistent with their beliefs and values and in keeping with prevailing sociocultural beliefs and care standards. The societal ring also houses those relationships that are deemed not to be integral to the patient such as those of colleagues, acquaintances and professional ‘contacts’.

This holistic concept of personhood is consistent with case reports and the results of studies carried out among cancer sufferers in Singapore.8–11 It is on this ethically sensitive, clinically relevant, culturally appropriate framework that we will base the wider effect and importance of the palliative rehabilitation within the end-of-life care setting.

**CASE PRESENTATION**

We present a case of a 61-year-old Chinese woman who was diagnosed with a left renal cell carcinoma in July 2013 after she presented with haemorrhagic cystitis. Although the patient underwent a left nephrectomy and adrenalectomy, she declined chemotherapy and radiotherapy. In November 2013, the patient presented with a recurrence of her cancer at the surgical bed, lung metastases, spinal involvement of her 11th thoracic vertebrae to her 1st lumbar vertebrae and brain metastases. Despite a protracted course of steroids and pazopanib and radiotherapy to her brain and spine, she experienced a loss of lower limb power and significant lower limb pain. This in turn led to significant existential, physical, social and psychological distress for the patient as well as her family. This situation was compounded by her unhappiness with her hospital surroundings and her on-going social concerns. In an effort to attenuate some of this distress and provide her with more rehabilitative and psychosocial support she was transferred to a hospice.

**Social history**

The patient was a pharmacy assistant married to a 65-year-old accounts clerk at a local transport company. They lived together in a three bedroom flat with their two adult children. Their elder daughter was 32 years old and an unmarried hair stylist while their 26-year-old son had just received a scholarship to John Hopkins University in Baltimore for his further studies in biomedical technology.

At the root of our patient’s concerns was her husband and daughter’s turbulent relationship, who were now no longer on talking terms, which was compounded by her son’s wish to defer his studies in America. The patient was concerned that her son’s decision would jeopardise his scholarship. She was also distressed at the lack of support from her eight siblings. As the youngest in the family, the patient had been used to being doted on by her siblings and was left bemused and distraught at what she felt was their sudden disengagement.

In addition, our patient was also finding it hard to come to terms with the significant impairments to her functioning. Her pain and weakness inhibited her ability to self-care and this depressed her. She had always been an active person who rarely asked for help. To find her completely reliant on others and being unable to ambulate potentially permanently was difficult for her to face. Her low mood also left her poorly motivated to communicate and this was compounded by the effects of her analgesics.

**INVESTIGATIONS**

A multidimensional palliative care assessment was carried out when the patient was admitted to the hospice. The key findings were that her pain in lower limbs was neuropathic in nature and while a combination of gabapentin, morphine, paracetamol and steroids had helped, she was still having pain on movement and was drowsy most of the time. Both symptoms responded to an escalation in both the breakthrough doses of opioids and the background dose of gabapentin and a reduction in her background opioid dose. It was only then that she would engage in conversations with the social worker, psychologists, the
physiotherapists, the occupational therapists and our psychospiritual team.

Given that the primary issue that was affecting the patient was her feeling that she was less than the person she was before, we summarise the findings conversation with her and illustrate their impact on her and her family using the Ring Theory.8–11

**Innate ring**
The patient was born a Christian and had embraced its teachings with great vigour some 15 years ago following the death of a close friend. Yet despite her strong faith she struggled to accept the serious changes to her life that had resulted from this sudden recurrence. She was ‘angry’ with God and had ‘lost’ her faith. She turned away visitors of her church and maintained that she was now an atheist.

This change reflected significant changes on her innate ring and provides an opportunity to elaborate on the understanding of the innate ring. The innate ring is composed of two rings. The first is the core and represents the belief that personhood is defined by either the patient’s ties with the divine or as a result of possessing human characteristics. This ring is unchanging and is only lost with the patient’s demise.

A ring encapsulating the core represents the secondary elements of innate personhood. It contains the beliefs, values and norms that the patient is born into. These facets are changeable and in our patient’s case, the ring contracted with her loss of faith and the abandonment of her familial values and religious roots.

**Individual personhood**
The loss of independence led the patient to become low in mood, compromising her ability to express her feelings, communicate her thoughts and critically to communicate with her family and friends. She was no longer able to show her affection and empathise with her daughter’s distress or her son’s anxieties despite being started on antidepressants some 2 months prior to her admission to the hospice.

While she did not lose her competence, her autonomy was hindered by her physical limitations and mood disturbances due to the circumstances that she found herself in. This compromised her individual ring.

**Relational personhood**
The loss of faith and her refusal to engage with her church friends who were her closest friends and confidantes significantly attenuated her relational ring with many of these relationships being relegated to her societal ring after being deemed no longer important to her. Similarly many of her siblings were relegated from her relational ring leaving only a handful relationships within her relational ring.

This contraction of her relational ring also provides an insight into how the various rings interact with one another. Changes in our patient’s individual and innate rings have a significant impact on the constituents of her relational ring. Similarly her societal ring was also compromised with her lack of engagement with her family and wider community, which in turn decreased in size.

**Societal personhood**
Aside from the relationships that are not deemed meaningful to her, our patient’s societal ring ensured that even with no family members present, she continues to be cared for in a manner that is in keeping with institutional standards, professional and legal standards and societal and cultural expectations.

**TREATMENT**
All aspects of the patient’s personhood appear to have been affected by the combination of her pain, loss of function and low mood. As a result, treatment was designed to address this triumvirate of concerns.

To begin with addressing her neuropathic pain through careful titration of neuropathic agents and readjustment of her opioids not only improved her sleeping patterns but also improved her exercise tolerance. In combination with psychospiritual support, counselling and a perceptible improvement in her mobility, this treatment programme also improved her mood.

For the patient, it was her rehabilitation and improved self-care that made the most difference to her, her outlook and mood. To begin with, regaining her sitting balance and being able to eat and conduct conversations in a sitting position was key. Here her physiotherapy and occupational therapist input was critical not simply for the physical support it provided her but in the realistic goal setting that was part of their treatment strategy. The patient later commented that this approach helped address her suffering and loss of dignity, which in turn improved her mood and helped her re-engage in her previous roles and ties.

**Suffering**
According to Beng et al’s classifications of suffering among palliative care patients, our patient’s suffering took four forms. This related to differential suffering which was ‘related to change and loss’, dependence suffering which was due to being dependent on others for ‘activities of daily living or instrumental activities’, empathic suffering which arose as a result of watching family members contend with the physical demands of her care and environmental suffering which arose largely as a result of the limitations forced on her due to restrictions in her mobility in the hospital setting.14 All four forms of suffering responded well to the intense rehabilitation that our patient received.

Without creating unrealistic and false hopes of recovery for the patient and family and through the careful maximisation of her abilities within the confines of her clinical limitations brought on by her underlying disease and comorbidities such as anorexia, lethargy, drowsiness and low mood which restrict participation, our patient was better able to care for herself and increase her independence while coming to terms with her condition. Her improvements in her capabilities and mood reduced her family’s distress and ameliorated her concerns with regards to them and how they were coping. Further through the employ of a wheel chair and being able to transfer from her bed to a chair using a ‘banana board’ her feeling of being ‘imprisoned’ in the hospice, receded.

Being able to support the emotional needs of her two children and still provide counsel and emotional support for her husband allowed the patient to fulfil the role she most desired to play. This in turn allowed her to ‘reclaim her self worth’ and dignity.

**Dignity**
A key consideration associated with self-worth and personhood is the maintenance of dignity. Beng et al14 evidenced that many patients measured their dignity by the manner that their family and loved ones regard them. Here, the patient was more reassured in being able to fulfil her central roles, care for herself and feel less like a burden to her family and as a result
reclaimed some of her dignity that she felt was lost when she was dependent on others for her basic care needs.

OUTCOME AND FOLLOW-UP
It is clear that at the start of her stay in the hospice, the patient’s personhood, dignity and indeed quality of life were severely compromised. It was her rehabilitation in tandem with the input from the social workers, psychologists, physiotherapists, occupational therapists and our psychospiritual team that allowed her to regain her personhood and restore her dignity and ameliorate her suffering. While she never regained full function, the employ of supportive measures allowed the patient to reconnect with her family and even with her church group.

DISCUSSION
The role of palliative rehabilitation in the preservation of the patient’s personhood cannot be underestimated and provides yet further evidence to its critical role in the provision of holistic end-of-life care. The combination of focused palliative rehabilitation that is practiced within the specific confines of a particular patient’s clinical, psychological and existential limitations allows for the reconstitution of a patient’s self-esteem, dignity and personhood. In our patient’s case, her rehabilitation allowed her to reassess her individual personhood. This in turn allowed her to once again manifest her true personality and assert her own values, wishes and beliefs. This re-establishment of her individual ring allowed, through the inter-related nature of the rings within the Ring Theory, for the re-establishment of her relational ring and the regeneration of her societal ring.

The ability to connect with others and assert her independence through appropriate treatment allowed the patient the chance to also reinvigorate her secondary ring and rejuvenate her spiritual beliefs (figure 2).

Clearly palliative rehabilitation can only be effective for certain patients and must be seen as part of a holistic approach yet its role in the overall practice of palliative care cannot be ignored.

Competing interests None.

Learning points
- The employ of rehabilitation in the end-of-life care can help some patients retain their personhood.
- The employ of palliative rehabilitation must be custom designed for each patient to suit their particular situation and needs.
- Rehabilitation in the end of life must be seen as a part of effective multidimensional appraisal and care.

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CASE REPORT

Traumatic transection of the pancreatic duct

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SUMMARY
A young man presented after a mountain biking accident having received a sharp blow from his handlebars to just below his right costal margin. Although initially he was clinically well and his primary investigations were normal, he was admitted for observation. After becoming peritonitic, his amylase increased to 502 U/ml, and an axial CT scan showed transection of the pancreas. An endoscopic retrograde cholangio-pancreatography (ERCP) was arranged in the operating department, confirming ductal damage. A stent was placed to bridge the pancreatic duct preoperatively, and a laparotomy lavage was carried out and an external drain placed. The patient recovered well and 12 weeks later, after the stent was removed, there was no evidence of pancreatic stricture. Pancreatic injuries must be suspected in blunt abdominal trauma, and preoperative endoscopic stenting may provide the definitive procedure for ductal injuries.

BACKGROUND
Injuries to the abdomen following trauma are common, and there exist many guidelines and protocols on the diagnosis and management of hepatic, splenic and renal damage. There is, however, little in the literature on the management of injury to the pancreas, specifically the pancreatic duct.

In our case a novel technique in the diagnosis and management of these injuries using perioperative endoscopic retrograde cholangio-pancreatography (ERCP) we were able to pass a stent across the pancreatic duct, meaning that we were able to preserve the patency of it during surgical repair.

CASE PRESENTATION
The patient, who was otherwise fit and well, had received a sharp blow to his upper abdomen from the end of his mountain bike handlebars to just below his right costal margin (fig 1).

He was in some pain and was tender under the bruise but initially showed no signs of peritonism.

Over the first 12 h he deteriorated, with the pain worsening (requiring opiate analgesia) and becoming peritonitic.

INVESTIGATIONS
Initial blood tests showed an amylase level of 102 U/ml, but after 12 h this had risen to 502 U/ml. An axial CT scan was performed showing a small laceration through segment four of the liver, as well as laceration of the pancreas (fig 2). This was confirmed on magnetic resonance cholangio-pancreatogram (MRCP, fig 3).

This pancreatic laceration was found to have completely transected the pancreatic duct during on-table ERCP, with contrast seen to leak from the proximal duct (fig 4). It was noticed, however, that there was still contrast seen in the distal pancreatic duct.

TREATMENT
As we were able to see contrast in the distal pancreatic duct (fig 4), we successfully passed a 7-French straight plastic stent across the pancreatic duct. This had the advantages of bridging the transected duct and allowing it to be easily identified and preserved during open repair of the pancreatic laceration.

OUTCOME AND FOLLOW-UP
The patient recovered well postoperatively. A drain placed next to the damaged pancreas was removed after 2 weeks and the patient was discharged. The pancreatic stent was removed endoscopically 12 weeks later.

Figure 1 Patient’s abdomen at presentation.

Figure 2 CT (with contrast) showing liver laceration.
weeks after placement, and repeat ERCP showed no leak from
the pancreatic duct.

DISCUSSION
A literature search found some publications regarding the endo-
scopic diagnosis and management of pancreatic duct injury. This
included a series of 14 pancreatic duct injuries and found that
there was an increase in complications should the diagnosis of
ductal damage be delayed for more than 24 h.1 A case report
was also found of a patient whose ductal injury was not recog-
nised or treated promptly, and after development of a pancreatic
pseudocyst the patient was managed with an ERCP and place-
ment of a pancreatic duct stent.2

In this patient, who initially presented with vague upper
abdominal pain, pancreatic duct damage was suspected, imaged
and diagnosed promptly. This allowed the endoscopic placement
of a stent before open repair. In our case the authors feel that
this endoscopic perioperative management avoided the need of
more drastic surgery such as a Whipple Procedure or Distal
Pancreatectomy that carry with them great morbidity.

LEARNING POINTS
▸ Clinicians should have a high index of suspicion for
pancreatic injury in trauma to the upper abdomen.
▸ Though diagnostic imaging tools such as CT and magnetic
resonance cholangio-pancreatogram (MRCP) may suggest ductal
damage, the authors feel that endoscopic retrograde
cholangio-pancreatography (ERCP) offers an excellent modality
to confirm or exclude transection of the pancreatic duct.
▸ In experienced hands, perioperative stent placement across
the damaged pancreatic duct can bridge the defect, and greatly
facilitates identification of the duct during open surgery.

Acknowledgements The authors thank Mr Amir Nisar.
Competing interests None.

REFERENCES
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the treatment of traumatic pancreatic duct injury. Gastrointest Endosc 2001
2 Cattaneo SM, Sedlack JD, Kalloo AN, et al. Management of a pancreatic duct injury
Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

CASE REPORT

A lightning strike to the head causing a visual cortex defect with simple and complex visual hallucinations

Ingo Kleiter,¹ Ralf Luerding,¹ Gerhard Diendorfer,² Helga Rek,¹ Ulrich Bogdahn,¹ Berthold Schalke¹

SUMMARY

The case of a 23-year-old mountaineer who was hit by a lightning strike to the occiput causing a large central visual field defect and bilateral tympanic membrane ruptures is described. Owing to extreme agitation, the patient was sent into a drug-induced coma for 3 days. After extubation, she experienced simple and complex visual hallucinations for several days, but otherwise largely recovered. Neuropsychological tests revealed deficits in fast visual detection tasks and non-verbal learning and indicated a right temporal lobe dysfunction, consistent with a right temporal focus on electroencephalography. At 4 months after the accident, she developed a psychological reaction consisting of nightmares, with reappearance of the complex visual hallucinations and a depressive syndrome. Using the European Cooperation for Lightning Detection network, a meteorological system for lightning surveillance, the exact geographical location and nature of the lightning strike were retrospectively retraced.

BACKGROUND

Central nervous system injuries caused by a direct lightning strike to the head are rare but exceedingly harmful.¹² Electrical current passing through the brain can lead to coagulation of brain tissue, intracranial haemorrhage and damage to the medullary respiratory centre. Secondary ischaemic brain injury may occur after cardiopulmonary arrest. Visual hallucinations often accompany a defective field of vision, which may be caused by a lesion anywhere in the visual pathway from the retina to the striate cortex.¹ Simple hallucinations usually consist of monochrome or coloured flashes (phosphenes) and are differentiated from complex, also known as formed, hallucinations. The latter typically develop with a latent period after acute lesions and persist for some days to weeks.¹³ Unlike patients with mental disorders or substance withdrawal, patients with visual field defects have full insight into the unreality of their perception.

We describe a patient who survived a lightning strike to the head, leaving a focal visual cortex defect with simple and complex visual hallucinations. After a clinically asymptomatic interval, serious psychopathological sequelae occurred.

CASE PRESENTATION

On 3 September 2004, a 23-year-old healthy woman was hit by a “bolt from the blue” while climbing on a ridge at 2750 m shortly before reaching the Latemar Peak in the Alps from a southern direction. The accompanying climber was about 50 m from the casualty and reported that at the time of the incident (about 15:00 Central European Time (CET)), the sky was clear and sunny. He heard cracking thunder and was thrown to the ground by a massive shockwave. The patient was also thrown to the ground, lost consciousness for a few seconds and was confused afterwards. She had no vision, and was dazzled by a bright light. On arrival of the air rescue team, her Glasgow Coma Scale was 9. She was hospitalised and, because of extreme agitation, was sent into a drug-induced coma for 3 days. The initial CT scan showed bilateral occipital oedema, but no intracerebral or subarachnoid haemorrhages or skull fractures (fig 1A).

Except for bilateral pleural effusions, her cardiopulmonary function was unremarkable. Burns at the occiput (fig 1B), at the right axilla, breast and trunk, and at the right lateral ankle were noted.

She had bilateral tympanic membrane ruptures.

After weaning from the respirator, she was initially alert and fully orientated. She complained of blurred vision and a large central bilateral visual field defect. Paroxysmal golden flashes were moving in her whole visual field. She was not able to read, but was able to recognise familiar faces. During artificial ventilation she had received midazolam, sufentanil, morphine and, prior to extubation ketamine and propofol; she did not have a history of illicit drug use.

In the evening, still awake and 6 h after extubation, strange phenomena occurred. These exclusively visual sensations consisted of unknown people, animals and objects acting in different scenes, as if in a movie. None of the persons or scenes was familiar to her and she was severely frightened by their occurrence. For example, an old lady was sitting on a ribbed radiator, who then became thinner and thinner, finally vanishing through the slots of the radiator. Later, on her left side a cowboy riding on a horse came from the distance. As he approached her, she tried to shoot her, making her feel defenceless because she could not move or shout for help. In another scene, two male doctors, one fair and one dark haired, and a woman, all with strange metal glasses and unnaturally brownish-red faces, were tanning in front of a sunbed, then having sexual intercourse and afterwards trying to draw blood from her. These...
formed hallucinations, partially with delusional character, were in the whole visual field and constantly present for approximately 20 h. At the time of appearance, the patient was not sure whether they were real or unreal, but did not report them for fear that she might be considered insane. However, as she was still frightened after cessation of the hallucinations, she insisted on being transferred to her hometown hospital. Over the next few days, she had increasingly better insight and later forgot about this episode.

At 3 days after extubation, she was in a euphoric mood. She reported persistently reduced vision with paroxysmal bright flashes surrounding a large scotoma in the right lower quadrant. The ophthalmological examination revealed a visual acuity of 20/125 in the right eye and 20/200 in the left eye. There were no signs of corneal or retinal lesions. Neurological examination was otherwise normal. Electroencephalography (EEG) disclosed mild diffuse slowing without a focus or discharges and an electrocardiogram (ECG) showed a bigeminus. MRI of the brain demonstrated mild bilateral occipital subarachnoid haemorrhages without affecting temporal structures.

At 10 days later, visual disturbances had improved, leaving a small inferior homonymous paracentral scotoma measuring approximately 5° immediately adjacent to the area of central vision on Amsler grid examination and tangent screen perimetry (Humphrey field analyser, Carl Zeiss Meditec, Jena, Germany). Ophthalmological examination was otherwise unremarkable and her visual acuity was 20/20 in both eyes. Pattern shift visual evoked potentials (30° checkerboard) from both eyes were persistently deformed and reduced in amplitude for the next 18 months (P2 N3; 3.6–5.4 μV; normal >5 μV). EEG now showed diffuse abnormalities and a right temporal focus (T6 according to the international 10–20 system), with intermittent slowing and spikes. When discharged, she was emotionally stable and optimistic.

At 7 weeks after the injury, a reduction in fast visual detection tasks and a decrease in non-verbal learning were found, whereas verbal learning measures and general level were within the normal range (table 1). This difference indicated an intact left temporal function and a right temporal lobe dysfunction, congruent with the persistent right temporal focus on EEG. At 20 weeks, non-verbal learning proficiency showed considerable improvement to results slightly below her general level of cognitive function. Impairment in visual detection tasks was constant. No significant differences from the population mean in non-verbal learning and in visual detection were found 18 months after the lightning strike; EEG remained pathological. Brain contrast-enhanced MRI 4 months after the lightning strike was normal.

Table 1 Improvement of neuropsychological function after the lightning strike

<table>
<thead>
<tr>
<th>Test results in z scores</th>
<th>7 weeks after injury</th>
<th>20 weeks after injury</th>
<th>18 months after injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruff 2 and 7</td>
<td>−1.1</td>
<td>−0.8</td>
<td>−0.4</td>
</tr>
<tr>
<td>CVLT</td>
<td>0.9</td>
<td>1.4</td>
<td>2.4</td>
</tr>
<tr>
<td>RVDLT</td>
<td>−0.7</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Full-scale IQ</td>
<td>0.8</td>
<td>0.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Results of the Ruff 2 and 7 (visual detection), CVLT (verbal memory), RVDLT (non-verbal learning) and the full-scale IQ, all transformed into z scores, are shown. A z score between −1 and 1 means that the performance of an individual is within 1 SD from the performance of a normal control of the same age and education. A z score smaller than −1 or bigger than 1 is interpreted as a significant difference.

CVLT, California Verbal Learning Test; RVDLT, Rey Visual Design Learning Test; WAIS-R, Wechsler Intelligence Scale for Adults—Revised.

Findings that shed new light on the possible pathogenesis of a disease or an adverse effect.

Figure 1 A. Axial CT scan of the head 3 h after the lightning strike showing diffuse occipital oedema. B Occipital burn injury 11 days after the lightning strike. Informed consent was obtained for publication of this figure.
At 20 weeks after the accident, the patient reported mournfulness, lack of energy and frequent nightmares with “strange flashbacks” for the last month. These nocturnal “flashbacks” were exactly replicating the complex visual hallucinations and paranoid delusions she had experienced the day after weaning from the respirator. She had difficulties in initiating and maintaining sleep, and her sleep was severely disrupted due to awakening from nightmares. She was treated with 20 mg paroxetine and was referred to a specialist in trauma therapy. Her nightmares vanished after approximately 2 weeks. During the next few months, she experienced several depressive episodes with suicidal ideation, but ultimately recovered.

Later, the patient only once re-experienced the complex hallucinations in the night after her grandmother’s house was on fire. On interview, even 24 months after the first occurrence, she remembered the different scenes very well and was able to describe every detail.

DISCUSSION

Owing to an increase in outdoor recreational activities, the number of casualties caused by lightning strikes in the mountains has grown in recent years. During lightning weather conditions, hikers and climbers at any location, not only in exposed areas such as ridges or near the summit, are at high risk of injury from lightning. Sometimes, thunderclouds may be overlooked in mountainous surroundings and a clear sky may give an erroneous feeling of security. Therefore, anticipation and avoidance of lightning is one of the most important precautions for outdoor activities in the mountains.

Lightning harms humans by its electrical effects, heat and concussive forces. The skin is highly resistant to electrical current, and often only superficial flashover burn injuries occur. If the current exceeds the breakdown strength of the skin, it preferably travels with structures of least resistance—that is, the vascular and the nervous systems. Direct lightning strikes to the head have a high degree of fatality or result in severe neurological sequelae. Our patient survived without major brain damage. The persisting scotoma was probably caused by direct electrical or thermal effects of the current at the occipital visual cortex, as depicted by transient focal oedema and abnormal visual evoked potentials. Given that the calcarine cortex is a highly vascularised structure, it could be particularly vulnerable to lightning damage.

The representation of the central visual field is located at the convexity of the occipital lobe, the occipital pole. Simple visual hallucinations such as phosphenes often accompany a defective field of vision, and occur rapidly. Complex visual hallucinations can arise from lesions of the entire visual pathway. They are located within the field of reduced vision and usually evolve after hours or days. Manford and Andermann observed that smaller rather than larger occipital lesions are associated with hallucinations, whereas lesions in the more anterior association cortex cause a loss of visual imagery. Hence, they speculated that hallucinations are generated as a release phenomenon in the association cortex when input from the primary visual cortex is missing and/or the cortical activity is altered by diminished input from the ascending reticular activation system, in particular serotonergic projections that exert an inhibitory action. Evidence for the involvement of the reticular activation system and its connections to the thalamus comes from patients with peduncular hallucinosis, where rostral brainstem lesions, most commonly of vascular origin, cause vivid, usually formed, colourful hallucinations.

Although in this patient the clinical, radiographic and neurophysiological findings suggest causality between the initial simple and complex visual hallucinations and the visual cortex defect, additional factors might have contributed to the formed hallucinations and paranoid delusions. First, visual hallucinations are known to occur during or after application of a wide range of sedative and anaesthetic drugs, in particular midazolam and propofol, both of which can also elicit sexual hallucinations. Second, in a delirium with an altered level of consciousness—for example, after withdrawal of sedatives—visual and tactile hallucinations may occur, typically fragmentary in nature and frightening to the patient. Finally, as is common in organic disease and similar to hypnagogical hallucinations, drowsiness could have triggered the long-lasting visual sensations with various, complete scenes. Unlike hallucinations caused by release phenomena of the visual association cortex, hallucinations due to epileptic discharges in these areas are not associated with the state of arousal and are usually brief, stereotyped and fragmentary in nature.

After recovering from acute injuries, our patient developed depression, sleep disturbances and nightmares with an exact recall of the visual hallucinations. Traumatic events, especially in combination with an Intensive Care Unit (ICU) stay, often lead individuals to form highly detailed, vivid and enduring memories that are called “flashbulb” memories. It was hypothesised that patients in the ICU are specifically prone to memories of nightmares, frightening hallucinations and paranoid delusions, because during an ICU stay memory formation might be reduced for external events and enhanced for internal events. Flashbulb memories have great emotional importance to the patient and later can be replayed as daytime recollections or nightmares in post-traumatic stress disorder. The reappearance of complex visual hallucinations on emotional stress has been described previously in two patients with occipital lobe lesions. It is unclear, however, whether these patients suffered from symptoms of post-traumatic stress disorder as well. Interestingly, in our patient, the recurring visual memories stopped under treatment with a selective serotonin reuptake inhibitor, supporting a role for perturbed serotonergic transmission in release phenomena of the visual association cortex.

The pathophysiology of lightning-related cerebral and neurobehavioural complications is not well understood. Although in some cases the electrical current of a direct strike to the head is high enough to cause generalised brain oedema, subarachnoid and intracerebral haemorrhages, others show scarce neuropathological abnormalities, mostly in the brain tissue adjacent to blood vessels. In this patient, the neuropsychological profile and the EEG findings demonstrated a constant right temporal dysfunction, remote from the apparent occipital lesion. Furthermore, a mild encephalopathy was shown by diffuse abnormalities on EEG, persisting for several months. Follow-up MRI of the brain failed to show brain atrophy or lesions in the respective regions. Secondary ultrastructural and chemical changes cannot be detected using common imaging techniques.

Often, however, regardless of whether the head was injured or not, lightning victims complain of long-term neuropsychological problems, including memory and attention deficits, and emotional lability. Although the exact origin of these symptoms is unclear, a psychobiological model involving psychological triggers, neurochemical (eg, neurotransmitter) alterations and—in cases such as this one—structural damage appears more plausible as compared with a purely psychogenic explanation.
This case illustrates that a direct lightning strike to the head can be survived with minor clinical deficits. However, delayed and long-term sequelae should be anticipated. Persistent neuropsychological and behavioural problems are common in lightning strike survivors; therefore, early injury-appropriate referral and rehabilitation are necessary.2,17

**LEARNING POINTS**

- Lightning strike can cause neuropsychological problems through direct brain injury or indirectly resulting in memory and attention deficits and emotional lability.
- In the present work, cortical visual hallucinations resulting from a lightning strike are described.
- Individuals at high altitude are vulnerable to lightning strike even if they are not caught in a storm.

**Acknowledgements** This article has been adapted with permission from Kleiter I, Luerding R, Diendorfer G, Rek H, Bogdahn U, Schalke B. A lightning strike to the head causing a visual cortex defect with simple and complex visual hallucinations. J Neurol Neurosurg Psych 2007;78:423–6.

**Competing interests** None.

**REFERENCES**

CASE REPORT

The assessment and treatment of a complex geriatric patient by an interprofessional primary care team

Stephanie H Bell, C Shawn Tracy, Ross E G Upshur, on behalf of the IMPACT Team

SUMMARY

Mr K is an 89-year-old married man with a number of comorbid conditions and multiple recent falls. He was referred to the IMPACT clinic (Interprofessional Model of Practice for Aging and Complex Treatments) as his primary care physician was concerned about his declining health and the growing care giver burden on his wife. Mr K’s condition was deteriorating while the complexity of his case was increasing; therefore, an in-depth team assessment was sought to determine the best management plan and to assess his capacity to remain at home (his expressed preference). The IMPACT team met with Mr K and his wife for a 2 h interprofessional assessment. A comprehensive care plan was developed including specific recommendations for implementing change. After the visit to the IMPACT clinic, Mr K’s care was returned to his regular family physician.

BACKGROUND

Primary care physicians (eg, family physicians or general practitioners) are providing care for a growing number of community-dwelling older patients with multiple chronic diseases. Typically, these clinical encounters are complex, requiring multiple decisions in a short time frame. This trend is only expected to accelerate with the ageing of the baby boom generation.

Increasing age is associated with increased health services utilisation. A recent study indicated that overall healthcare utilisation increases significantly with age. The mean number of utilisation events for patients aged 65+ years was 70 events per annum, and this rises to 130 by the age of 85. Drugs and diagnostics account for the majority of these events.

Primary care physicians are expected to provide an increased number of preventive services, while being both evidence based and patient centred. Current models of primary care do not allow sufficient time to address multiple health needs or to create comprehensive care plans. A recent multinational study found that German, British and American primary care physicians are allocated 6, 10 and 10 min for a routine visit, respectively and 12, 20 and 36 min for a complete physical, respectively.2

As clinical trials generally exclude patients with multiple chronic conditions, most clinical practice guidelines (CPGs) have a single-disease focus.3 Also, CPGs might conflict with each other and might not be appropriately applied to complex patients.4 Good quality care requires the input of many allied health professionals in a team-based environment.5 The present case illustrates an innovative interprofessional approach to providing care for a complex older patient with multiple diagnoses and multiple medications. These patients see an increased number of specialists and are often subject to multiple referrals for diagnostic testing and assessment. Furthermore, it is challenging for the primary care physician to manage their care effectively as it is not possible to address a large number of issues in a short visit. Also, additional support and expertise by other healthcare providers, working as a team, can help to identify patient relevant needs and allow for the development of a comprehensive patient-centred plan.

The IMPACT clinic features an interprofessional team that works with the patient, care giver and referring family physician. During the 2 h appointment, a diverse range of medical, functional and psychosocial issues can be investigated. To date, 120 patients have been seen in IMPACT, and a number of patients have visited more than once (188 total visits). More than 60 residents have participated in IMPACT for an average of three rotations each.

The IMPACT clinic begins with a 20 min quality of life interview performed by a medical resident, while the rest of the team watches on a closed circuit TV. As the interview takes place, the rest of the team takes note of the interview and has smaller discussions around what is going on. The resident then returns to the room and has a discussion with the entire team around the patient, and teams main concerns and priorities for the visit are determined as a group. Additional healthcare providers perform further assessments depending on the patient’s needs. This may include nursing, physiotherapy, occupational therapy, pharmacy, nutrition and social work. Once these assessments are performed, the team reassembles to create an interprofessional care plan for the patient and follow-up plan for the referring family physician.

CASE PRESENTATION

Mr K is an 89-year-old married man living with his wife in a condominium in suburban Toronto presented with chronic kidney disease, bipolar disorder, spinal stenosis, aortic aneurysm, peripheral vascular disease, gout, complete incontinence secondary to TURP (×2) and numerous falls.
Previously, Mr K had been completely worked up, including a full neurological and orthopaedic assessment. It was the opinion of the orthopaedic surgeon that there were no surgical interventions that would benefit Mr K. Likewise, a neurological consultation recommended no further interventions. In both instances, care was returned to the primary care physician. Mr K suffers from chronic imbalance, and prior to coming to IMPACT, he was having great difficulty managing his activities of daily living, past his safety threshold and in need of a new care plan. His wife is able-bodied but suffers from several chronic health conditions herself. She requires joint replacement surgery but has delayed this in order to meet the care needs of her husband. She had been experiencing increasing caregiver stress in the months leading up to their visit to the IMPACT clinic. Two weeks before Mr K’s visit, he had a bad fall where he tore his left rotator cuff. His stated preference is to remain in his home as long as possible.

INVESTIGATIONS
Mr and Mrs K were introduced to the team and taken to an exam room by his regular family physician and a second year family medicine resident. It was explained to Mr K that the resident would like to ask him some questions and that the primary care physician and the rest of the IMPACT team would be viewing the interview on a closed-circuit TV in a room across the hall (figure 1). An initial 30 min interview was conducted by the family medicine resident while the team watched. This initial interview ‘unpackaged the patient’s story’ as follows:

Mr K has lived in his current home (a condominium apartment) for the past 10 years. He had been regularly using the pool and exercise room, but not since his fall 1 month prior, in which he was not found for 2 h. In the daytime, Mr K is reliant on his wife for depends change. He is able to bathe himself, although his wife must assist him with all transfers. At night, Mr K requires a diaper change every 2 h, which greatly increases caregiver burden as he is not able to do this alone. He also noted to be highly intelligent, and despite some cognitive decline, he remains able to perform complex activities such as telephone banking.

Mr K has a complex medication regimen. Mrs K assists with medication taking. Mr K’s regular daily medications are as follows: Lipitor (10 mg tablet once a day), ferrous gluconate (300 mg tablet once a day), valproic acid (500 mg tablet once a day), flomox (0.4 mg tablet once a day), allopurinol (200 mg tablet once a day), quinine sulphate (200 mg tablet once a day), zopiclone (¼ of a 7.5 mg tablet once a day), TYLENOL (1000 mg tablet three times a day), ibuprofen (400 mg twice a day), calcium/magnesium (1 tablet twice a day), vitamin B (1 tablet once a day), vitamin D (1000 IU once a day) and a multivitamin (1 tablet once a day). In addition, Mr K keeps a supply of several bowel medications at home (docusate, lactulose and senokot). Mr K has had many falls. His wife reports that he has very poor balance and now falls frequently. On the day before his visit to the IMPACT clinic, he fell twice, in the living room and in the bathroom. He is now unable to pick himself up and, therefore, Mrs K feels uncomfortable leaving her husband unattended. He now leaves home only for appointments. Consequently, the couple has become increasingly socially isolated, which is exacerbated by limited social supports. Mobility is difficult but facilitated with a rollator walker. Transfers are very difficult. Mr K reports pain in his neck and uses a special pillow at night, with a hot pack. Mr K goes to the physiotherapist once per week to improve his gait, his transfers and his neck pain. Although he no longer uses the gym, he continues to walk with his rollator to the mailbox in his condominium daily.

Mr K reports a good appetite and no weight loss. Since his wife has fibromyalgia and increasing fatigue, she is no longer able to prepare meals at home. As a result, Mr K often eats fast food and frozen meals. Mr and Mrs K’s main concerns at this visit were his falls, mobility and incontinence, as well as her stress and fatigue. The team’s concerns aligned with those of Mr and Mrs K. Following the initial interview by the resident, other members of the interprofessional team performed specific assessments on Mr K.

Figure 1 Several IMPACT team members confer (foreground) while observing fellow team members interact with the patient (inset).
OUTCOME AND FOLLOW-UP
Following the visit, the IMPACT team discussed and documented a follow-up plan for Mr K’s primary care physician. Each area of concern and goal was documented. For each concern, a specific task was delineated for the primary care physician at Mr K’s next visit, as well as a plan for long-term care.

At Mr K’s next primary care visit, the family physician is to inquire whether Mr K is still able to get to the mailroom and whether he is attending physiotherapy. His shoulder AROM will be measured, and he will be told to reduce ibuprofen, as tolerated.

Mr K will be asked about the start date for the falls prevention programme and whether the home safety assessment has been performed. His valproic acid levels will be reassessed to ensure the dose is not too high and is not contributing to his falls. In the longer term, the primary care physician will confirm completion of the falls prevention programme and will raise the issue of alternate forms of supportive housing.

DISCUSSION
The IMPACT clinic uses a unique approach in caring for complex older patients. As the number of chronic conditions increases, the number of treating physicians, medical visits and medications prescribed all increase. The objective of the IMPACT clinic is to identify each patient’s complexities and personal concerns so that they can be addressed in comprehensive fashion by an interdisciplinary team. Routine primary care visits allow neither for an in-depth patient-centred assessment nor for the establishment of detailed care plans. In the IMPACT clinic, the initial interview, the team discussion and the various assessments are determined by the patient’s needs. This improves the patient’s care and efficacy for change/improvement and provides a very clear and comprehensive picture for future visits to the primary care physician. Indeed, the interdisciplinary care plan provides instruction and ongoing support for the physician and patient alike.

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With regard to care giver stress and additional health risks, the family physician will inquire about in-home support, whether the two-way phone system has been installed and whether Mrs K is now able to leave the home more often. A care giver anxiety test will be performed, and Mrs K’s sleep hygiene will be evaluated as a gauge of Mr K’s continence and improvement in sleep. At a future visit, a MoCA assessment will be performed in order to assess further cognitive impairment in Mr K.

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CASE REPORT

Successful weaning from mechanical ventilation in a patient with surfactant protein C deficiency presenting with severe neonatal respiratory distress

Jeroen van Hoorn,1 Arno Brouwers,2 Matthias Griese,3 Boris Kramer2

SUMMARY
The clinical course and treatment in the first 2.5 years of life of a term-born girl with a severe onset of respiratory symptoms in the neonatal period caused by a p. Cys121Phe/C121F mutation in the gene of surfactant protein C (SFTPC) is described. During the first 9 months of life, she was mechanically ventilated. With methylprednisolone pulse therapy and oral prednisolone, she could eventually gradually be weaned from mechanical ventilation. At the age of 2.5 years, she is in a good clinical condition without any respiratory support and has a normal nutritional status and neurodevelopment. This clinical course with neonatal onset of respiratory insufficiency is remarkable since most patients with SFTPC mutations present with milder respiratory symptoms in the first years of life.

BACKGROUND
Respiratory diseases caused by inherited disorders of the surfactant metabolism are quite rare.1 One of these disorders is surfactant protein C (SFTPC) deficiency in which the severity and course in time may be variable. Most patients present with mild respiratory symptoms in the first years of life, where only a minority presents in the neonatal period.2 The variability in severity and course in time makes assessment of the prognosis for an affected individual very difficult. There is no established curative treatment available for inherited disorders of surfactant metabolism besides lung transplantation. In this case report, we describe a patient with a severe and early onset of respiratory symptoms with a remarkable improvement after months of mechanical ventilation and treatment with steroids.

CASE PRESENTATION
The patient’s parents were non-consanguineous and healthy with no family history of respiratory disease. After an uncomplicated pregnancy with induction of labour at a gestational age of 41 weeks and 1 day, a baby girl was born with a birth weight of 3755 g. Apgar scores were 8 and 9 at 1 and 5 min, respectively. Within 24 h after birth, she developed signs of respiratory distress and increased oxygen demand for which she was treated with oxygen, nasal continuous positive airway pressure (CPAP) and antibiotics. On the fourth day after birth, the clinical condition worsened with increasing respiratory distress, for which she was intubated and received conventionally pressure-controlled ventilation. She received two doses of surfactant with only a transient improvement in oxygenation. Echocardiography showed a structurally normal heart with little signs of pulmonary hypertension for which NO trial was performed with little effect. X-ray of the lungs revealed an increased whitening of the lungs consistent with respiratory distress syndrome (RDS). Bacterial and viral cultures were negative. After a trial with furosemide, she was extubated at the age of 2 weeks and received respiratory support by nasal CPAP and supplemental oxygen (FiO2 30–40%). She remained in respiratory distress and her clinical condition worsened again for which she was reintubated and again received conventionally pressure-controlled ventilation. This time, it was not possible to wean her from mechanical ventilation. Meanwhile, mechanical ventilation was complicated by oxygenation problems and carbon dioxide retention for which mechanical ventilation had to be adjusted. Neither a switch to high frequency oscillation (HFO) nor the change to an endotracheal tube with a larger diameter significantly increased the respiratory condition of the girl. A high-resolution CT (HRCT) of the lungs at the age of 3 weeks showed patchy areas of ground glass attenuation with thickening of interlobular septae also called ‘crazy paving’ pattern (figure 1). Bronchoalveolar lavage (BAL) showed signs of active inflammation with infiltration of granulocytes and alveolar macrophages. An open lung biopsy at the age of 7 weeks revealed a pattern of interstitial pneumonitis. Hydroxychloroquine was started as an antiinflammatory agent because the HRCT was consistent with interstitial lung disease but did not have any effect. At the age of 3 months, she was still on mechanical ventilation with high settings (peak inspiratory pressure (PIP): 35 cm H2O, positive end expiratory pressure (PEEP) 10 cm H2O, FiO2 45%) and unable to wean despite permissive hypercapnea and treatment with hydrocortisone. She was transferred to a hospital with expertise in pulmonary lavages in young children as a treatment option for alveolar proteinosis, the diagnosis which was suspected at that time.1 After two sessions of pulmonary lavages without improvement, the child was referred back. DNA sequence analysis of the SFTPB and ABCA3 genes were negative at that time. A later SFTPC gene analysis revealed that she was a heterozygous carrier of a p.Cys121Phe/C121F mutation encoded by exon 4. At the age of 4.5 months, a tracheostoma was placed because a...
long period of mechanical ventilation was expected. After the tracheostoma was placed, sedation could be stopped which was important because of its negative effect on neurodevelopment and to improve further weaning from mechanical ventilation. Treatment with azithromycin was started for its immunomodulatory function. Corticosteroids were started again, consisting of methylprednisolone pulse therapy (300 mg/m²/day intravenously during 3 days) and oral prednisolone 2 mg/kg/day. Initially, the methylprednisolone pulse therapy was started with 3-week intervals. Later, the frequency was decreased to every 4–5 weeks. After starting corticosteroids, ventilator settings and oxygen need substantially decreased, and the girl could be weaned from mechanical ventilation. At the age of 9 months, she was ventilated with pressure support ventilation with mild settings (PIP 14 cm H₂O, PEEP 6 cm H₂O, FiO₂ 25%). To wean the girl further from mechanical ventilation, ventilator-free intervals were started and increased to a maximum of 4 h a day in which supplemental oxygen was given by nasal cannula. With this ventilator setting, she was discharged from the hospital with home mechanical ventilation. After discharge, she could be further weaned from mechanical ventilation and is without respiratory support or chronic supplemental oxygen since the age of 18 months. The oral prednisolone was tapered, and after 4 months substituted by oral administration of hydrocortisone in an equivalent dosage which was further reduced over time and stopped at the age of 19 months. Methylprednisolone therapy was stopped 1 month after complete weaning from mechanical ventilation. A HRCT of the lungs at the age of 21 months showed an improvement of the ground glass aspect (figure 2). The girl was initially fed with normal formula through a gastric tube which was well tolerated. Because of feeding intolerance along with vomiting, mucous diarrhoea and poor weight gain, the normal formula was switched to an elemental formula on the suspicion of a cow milk allergy. After the switch to this elemental formula, her stools normalised and her weight gain was satisfactory. Because of prolonged feeding through a nasogastric tube at the age of 8 months, a percutaneous endoscopic gastrostomy (PEG) tube was placed. During the second year of life, oral feeding was introduced and gastric tube feeding could be stopped. Despite the severe clinical course with prolonged mechanical ventilation and treatment with systemic corticosteroids, her length growth and weight gain are within the normal range. Before discharge, a cerebral MRI was made at the age of 9 months, which showed delayed myelination probably caused by the treatment with systemic corticosteroids during a prolonged period of time. There was also a significant neurodevelopmental delay mainly caused by the prolonged mechanical ventilation and accompanying sedation. After discharge, she was treated by a multidisciplinary rehabilitation team, and her neurodevelopment increased in time. A detailed neurological examination at the age of 2.5 years showed a completely normal neurodevelopment.

OUTCOME AND FOLLOW-UP

At the age of 2.5 years, the girl is in a good clinical condition without marked signs of respiratory distress and without chronic demand of supplemental oxygen. She is currently orally fed with a cow milk-free diet. Her length growth and weight gain are within the normal range. On detailed neurological examination, she showed normal neurodevelopment.

DISCUSSION

Surfactant is a complex mixture of phospholipids and proteins consisting of four surfactant-associated proteins and is produced by alveolar type II cells. Surfactant proteins A and D are hydrophilic proteins and contribute to the host defence in the lung, whereas surfactant proteins B and C are hydrophobic proteins which reduce surface tension, and thus prevent alveolar collapse. The first mutation in the SFTPC gene was described in 2001. Currently, over 35 dominantly inherited SFTPC mutations have been described in association with acute and chronic lung diseases in patients. The genetic defects result in a disruption of the normal processing of pro-SPC to mature SPC. Depending on the site of the mutation, misfolded pro-SPC, reduced or no mature SPC are produced. Precursors of SPC may accumulate in alveolar type II cells, resulting in an activation of cell stress responses and subsequent cellular injury and apoptosis. In contrast to patients with mutations on SFTPB who usually present in the neonatal period with acute and severe respiratory symptoms, patients with SFTPC mutations mostly present with respiratory symptoms later in life. The clinical course in these patients may be variable over

**Figure 1** High resolution CT (HRCT) of the lungs at the age of 3 weeks showing patchy areas of ground glass attenuation with thickening of interlobular septae also called ‘crazy paving’.

**Figure 2** High resolution CT (HRCT) of the lungs at the age of 21 months showing an improvement of the ground glass aspect.
time with some patients having persistent chronic respiratory problems which may improve and resolve, but others require lung transplantation, and some ultimately succumb. This variability in severity and course of the disease makes assessment of the prognosis for an affected individual very difficult. In every term neonate with an unexplained respiratory distress in the first week of life, which requires mechanical ventilation without clear improvement and no obvious cause of disease, an evaluation for inherited disorders of surfactant metabolism should be considered. The steps in this diagnostic approach heavily rely on genetic testing and, if inconclusive, lung biopsy. HRCT of the lungs and analysis on BAL fluid may give some more hints into the direction of an interstitial lung disease; however, these will not be genetically diagnostic. After establishing the diagnosis, consultation with or referring to an expertise centre is advisable in particular since there is no established curative treatment for inherited disorders of surfactant metabolism available besides lung transplantation. Besides long-term respiratory support and supplemental oxygen, hydroxychloroquine and corticosteroids are used in patients with interstitial lung disease. They may provide some improvement because of their anti-inflammatory effects and the inhibitive role of hydroxychloroquine in the intracellular processing of pro-SPC, but have not been systematically evaluated. There are very few case reports with such a severe and neonatal onset of respiratory failure due to a SFTPC mutation. The patient described by Soraisham et al was mechanically ventilated during the first week of life, associated with dexamethasone and repeated surfactant replacement therapy. The child died on day 44 because of unremitting hypoxaemia for which ventilator management was withdrawn. Poterjoy et al described a patient who was mechanically ventilated until the age of 20 months when she underwent a bilateral lung transplantation. After the lung transplantation, the child was weaned from mechanical ventilation and discharged home at the age of 23 months. Recently Hepping et al described a patient who was mechanically ventilated from the first day of life and treated with exogenous surfactant and cortisone without any clinical improvement. After treatment with hydroxychloroquine, the respiratory condition improved within 2 weeks so that the patient could be extubated. Our patient had a severe and early onset of respiratory symptoms with a remarkable improvement after months of mechanical ventilation and especially treatment with steroids. Hydroxychloroquine did not improve her respiratory condition.

In conclusion, in this paper, we described the clinical course and treatment of a girl with an early and severe onset of respiratory symptoms caused by a novel p.Cys121Phe/C121F mutation of the SFTPC gene. This case illustrates that in every patient with unexplained respiratory distress without improvement in time and signs of interstitial lung disease on HRCT scan, genetic disorders of the surfactant metabolism should be considered. Consultation and collaboration with experts in the evaluation of children with disorders in surfactant metabolism is important to collect experiences made in individual cases. This is possible with the help of website http://www.kids-lung-register.eu. In order to improve outcome in the future, patients should be followed and treated in prospective studies, available now in Europe (http://www.childeu.net).

**Learning points**

- In every patient with unexplained respiratory distress without improvement in time and signs of interstitial lung disease on HRCT scan, genetic disorders of the surfactant metabolism should be considered, although they are quite rare.
- Most patients with a SFTPC deficiency present with mild respiratory symptoms in the first years of life; however, neonatal and severe onset, as in our patient, is described.
- In contrast to patients with SFTPB deficiency, patients with SFTPC deficiency can be successfully weaned from mechanical ventilation with treatment of systemic corticosteroids.
- Consultation and collaboration with experts in the evaluation of children with disorders in surfactant metabolism is important to collect experiences made in individual cases. Patients should be followed and treated in prospective studies in order to improve outcome in the future.

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**Contributors** JvH and BK wrote the first concept of the manuscript. AB and MG critically revised it. After drafting the final version by JvH, all authors approved it for publication.

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Neonatal hyperinsulinism secondary to maternal intake of high-sugar drinks

Nicol Jon West, Matthew Thorpe

SUMMARY
The authors report a macrosomic term male infant who developed refractory hyperinsulinism requiring 20 mg/kg/min intravenous dextrose (usual range 4–6 mg/kg/min) and treatment with diazoxide 10 mg/kg/day. His blood insulin level at 6 h of age was 22.3 μU/l (reference range <5 μU/l) with corresponding laboratory blood glucose of 0.3 mmol/l. There was no detected maternal diabetes but the mother revealed she drank 2 l of ‘lucozade energy’ a day in the past 3 months of pregnancy. The hyperinsulinism resolved by day 7. Transient neonatal hyperinsulinism is known to be associated with maternal diabetes but has not previously been reported as secondary to high maternal sugar intake. This case highlights that significant hyperglycaemia secondary to transient hyperinsulinism can occur in infants of mothers without identified diabetes.

BACKGROUND
This is a report of a neonate who developed significant hypoglycaemia and hyperinsulinism after birth. During her late pregnancy the mother had been drinking large amounts of a high sugar drink. She was not identified as having diabetes in pregnancy. There is no specific national guidance that a high sugar intake in pregnancy is potentially harmful to the fetus. We felt this report was important to highlight this issue. It also demonstrates that infants can present with hypoglycaemia secondary to a transient hyperinsulinism even if there is no history of maternal diabetes, which can have a significant morbidity and mortality.

CASE PRESENTATION
We report a macrosomic term male infant who developed refractory hyperinsulinism requiring 20 mg/kg/min intravenous dextrose (usual range 4–6 mg/kg/min) and treatment with diazoxide 5 mg/kg/day. His blood insulin level at 6 h of age was 22.3 μU/l (reference range <5 μU/l) with corresponding laboratory blood glucose of 0.3 mmol/l. Echocardiography demonstrated ventricular septal hypertrophy. There was no maternal history of diabetes but the mother revealed she drank 2 l of ‘lucozade energy’ a day in the last 3 months of pregnancy which contains 174 g glucose in 2 l. WHO recommended daily amount is around 50 g (10% of diet).

The hyperinsulinism resolved by day 7. Investigation did not reveal an alternative cause. Transient neonatal hyperinsulinism is known to be associated with maternal diabetes but has not previously been reported to be caused by high maternal sugar intake without the detection of diabetes.

The patient was the first child of his 23-year-old mother. She had no medical concerns during her pregnancy. She had normal booking bloods and normal 20 week ultrasound scan. She required no further antenatal scans. She did not have evidence of gestational diabetes on urine dipstick, although blood tests such as glycosylated haemoglobin level were not checked before or after delivery. She was on no medication and was not identified as having a high BMI. She developed hypertension and proteinuria 3 days before delivery. There was rupture of membranes 72 h before delivery and she had a raised C reactive protein (CRP). Labour was augmented 12 h before vaginal delivery at term.

Birth weight was 3.910 kg on 75th–91st centile with a head circumference of 36.5 cm on 75th–91st centile. He required no resuscitation at birth with apgars of 8 at 1 min and 10 at 5 min. Blood glucose remained <2.4 mmol/l up to 6 h of age despite breast and bottle feeds.

He was noted at this point to be jittery and blood glucose was identified as 1.8 mmol/l. He was given an intravenous bolus 10% dextrose followed by 10% dextrose 60 ml/kg/day. A full sepsis screen was taken which revealed a CRP of 3 mg/l and cerebrospinal fluid and blood cultures were later negative. A chest x-ray was normal. He had no evidence of haemolysis. His CRP rose later to 38. Glucose levels remained suboptimal and over 24 h intravenous dextrose was increased to 90 ml/kg/day 15% dextrose and then to 20% dextrose at 120 ml/kg/day via a central umbilical line. This is a rate of 20 mg/kg/min (usual requirement 4–6mg/kg/min). With this blood glucose levels were consistently normal. However, hypernatraemia developed secondary to fluid overload. On clinical examination, he was oedematous and had a systolic murmur. Echocardiography revealed a patent ductus arteriosus as well as intraventricular septal hypertrophy.

On day 2, the hypoglycaemia screen had revealed a raised insulin level. On discussion with tertiary paediatric endocrinology team diazoxide was commenced at 5 mg/kg twice daily. This was started in part due to the problems of fluid overload on the high volume of intravenous 20% dextrose and also because of identified hyperinsulinism. From day 2 blood glucose levels remained normal and the dextrose and diazoxide requirements were gradually reduced until ceasing on day 7. By then he had established full enteral feeds.
During the first day the mother revealed that she drank 2 l of lucozade a day for past 3 months of pregnancy. Two litres of ‘lucozade energy’ contains 176 g glucose. WHO recommend daily sugar intake of 48 g (10% of diet).

INVESTIGATIONS
Insulin level 22.3 (normal <5), C-peptide 2751 (normal <600), Organic and amino acids, acyl carnitine, 17 OH progesterone, ammonia and lactate were normal. Growth hormone appropriately raised at >96, no urinary ketones. Repeat ECHO revealed closing patent ductus arteriosus and bulky intraventricular tissue.

DIFFERENTIAL DIAGNOSIS
Neonatal hypoglycaemia as defined as a serum glucose level of 2.6 mmol/l or lower is a common occurrence, particularly in the few hours post delivery. It is considered pathological if it is persistent despite feeding or associated with clinical symptoms of hypoglycaemia. It is important to identify and manage hypoglycaemia promptly as clinical effects can be severe. These include seizures, coma and death. Neonatal hypoglycaemia has been found to be associated with adverse long-term neurological effects, as have neonatal seizures independently.¹ ²

Neonatal hypoglycaemia can be caused by several different mechanisms. It is a frequent complication in small or preterm infants and is secondary to reduced glycogen stores. Blood glucose levels should also be monitored in sick infants because they have increased glucose requirements. It can be secondary to a reduced ability to transport glucose to the required cells, this occurs in hypoxic brain injury which affects glucose transporters. It can also occur in many metabolic disorders such as galactosaemia, organic acidemias, glycogen storage disorders and fatty acid oxidation defects. Hypoglycaemia also commonly occurs in an infant because of inadequate intake – such as a period of reduced feeding.

Hyperinsulinism is an important cause of neonatal hypoglycaemia and as demonstrated by this case can cause a severe, refractory hypoglycaemia. Hyperinsulinism can be transient or prolonged. Causes of prolonged hyperinsulinism include focal and diffuse pancreatic adenomatous hyperplasia and are associated with several gene defects which result in increased β-2 cell insulin production. The more common mutation, SUR K channel produces a severe, diazoxide resistant hyperinsulinism. The second most common mutation causes the hyperinsulinism/hyperammonaemia syndrome which may have a milder clinical course.³

There are many causes of transient neonatal hyperinsulinism. The most common is secondary to a mother with diabetes. This is because glucose freely passes into the placenta from the maternal circulation, and the neonatal pancreas responds by increasing insulin secretion and becoming hypertrophied. On delivery, the maternal glucose supply stops and it takes time for the neonatal pancreas to adjust. It can cause significant hypoglycaemia, but normally resolves in a period of days.

Other causes include intrauterine growth retardation, perinatal asphyxia and rhesus immunisation. The hyperinsulinism secondary to these causes appears to often take longer to resolve. Beckwith–Wiedemann syndrome also causes a transiently increased insulin secretion secondary to increased insulin-like growth factor 2 expression. The infant in this report did not have the clinical features of this condition. Umbilical artery catheterisation has also been linked, thought to be secondary to increased glucose load to the coeliac axis. In this case, the high insulin level was detected before catheter insertion. The baby in this case report did have a raised CRP suggesting an infection, although cultures were negative. Sepsis is linked with reduced insulin sensitivity and hyperglycaemia so is unlikely to explain the hyperinsulinism.

One study found an association with high neonatal serum lactate levels.⁴ The cases resolved within a period of 3 – 4 weeks. This baby’s lactate level was not elevated – 2.6 mmol/l at birth. Eight of 54 babies with parents who had diabetes caused by HNF4A mutation had transient hypoglycaemia - 3 with hyperinsulinism and were found to be heterozygous for the mutation. In this patient, neither parent had a history of diabetes.⁵ There is a published report of two cases of transient neonatal hyperinsulinism with no identified gestational or other recognised cause.⁶ They did not report on maternal diet. Both responded quickly to diazoxide.

Hyperinsulinism/hyperammonaemia syndrome was also considered. The initial ammonia level was 108, repeat at 6 months age was normal. On assessment at 6 months of age he was a well, thriving baby with normal fasting glucose level.

TREATMENT
The infant with hypoglycaemia may present with jitteriness, poor feeding, irritability, respiratory distress, apnoea, hypothermia, seizures and coma. Initial management depends on if the baby is symptomatic and degree of hypoglycaemia. As it is common to identify blood glucose levels under 2.6 mmol/l soon after birth current UK guidelines advise that for infants of diabetic mothers to check levels 2–4 h after birth, but recommend early feeding.⁷ If the blood glucose level is low then management is often initially with feeding, including naso/oro-gastric tube feeds if required. Particularly if there is no history of maternal diabetes, consideration is given to performing a screen for sepsis and commencing antibiotics. This is because hypoglycaemia can be secondary to illness. Another consideration is to performing a screen for metabolic causes of hypoglycaemia – which would include an insulin level.

If feeds are unsuccessful or not tolerated or if the baby has symptoms of hypoglycaemia intravenous dextrose is instituted, initially with 10% dextrose. Concentration and volume may need to be increased. If concentrations over 12.5% dextrose are used a central line is recommended. Consultation with a paediatric endocrinology team is useful. In cases of identified hyperinsulinism, diazoxide is often effective as it directly inhibits insulin release. Glucocorticoids are generally no longer used as they have not been shown to always be effective.⁸ Glucagon infusions can be used for a period of a few days. Ultimately, in severe, persistent hypoglycaemia secondary to hyperinsulinism, which is usually secondary to a genetic cause or focal pancreatic adenoma, pancreatectomy or partial pancreatectomy may be required.

OUTCOME AND FOLLOW-UP
Follow-up at 6 months of age revealed a thriving baby with a normal fasting glucose and normal ammonia level. One year cardiac follow-up revealed resolving intraventricular septal hypertrophy.

DISCUSSION
What is known about neonatal hyperinsulinism and maternal glucose tolerance?
There is established evidence of neonatal hyperinsulinism secondary to maternal diabetes but no published reports of
hyperinsulinism secondary to isolated high maternal sugar intake. It is possible that she could have had a degree of insulin resistance but still with normal urinalysis as found on routine antenatal care.

Westgate detected raised cord insulin levels of 5.6–13.0 mU/l (40–94 pmol/l) in mothers with gestational diabetes, even with normal glucose tolerance postpartum. Jensen found no significant trend between maternal glucose intolerance (2 h glucose <9) and neonatal hypoglycaemia, but did with macrosomia and preterm delivery. However, Pirc found no difference in cord blood insulin levels between mothers with mild gestational diabetes and controls after diet advice.

The HAPO group studied glucose levels in non-diabetic mothers at 28 weeks gestation and found a strong association with maternal fasting glucose values and foetal size and hyperinsulinism at birth, and a significant association of neonatal hyperglycaemia with the 1 h maternal oral glucose tolerance test level.

Neonatal ventricular septal hypertrophy is a known potential consequence of maternal diabetes. Demiroren et al also demonstrate its presence in macromomie babies with no history of maternal diabetes. Way et al showed this abnormality tends to normalise by the end of the first year of life.

CONCLUSIONS
This is a report of significant neonatal hypoglycaemia secondary to hyperinsulinism. It may be related to maternal high glucose intake in pregnancy. The mother was not identified as having developed diabetes in pregnancy. The baby had a significant risk of morbidity and mortality.

There is current evidence that reduced maternal glucose tolerance, even at levels not considered to be clinically significant is associated with raised neonatal insulin levels. This report demonstrates the extent of neonatal hypoglycaemia that may occur.

In the UK, there is clear advice given for alcohol and caffeine intake in pregnancy. UK NICE guidelines 2008 state the ‘importance of a balanced diet’ but do not specify sugar intake. Routine screening for diabetes is recommended if there is a high BMI, previous macrosomic baby, previous gestational diabetes, family history of diabetes or family origin with a high prevalence of diabetes. This mother did not qualify for screening. It is possible that she could have developed a degree of insulin resistance not detected on urinalysis. The purpose of this article is not so much to describe a new mechanism for neonatal hyperinsulinism but more to demonstrate that significant hyperinsulinism may occur in infants of mothers not identified as having established diabetes.

The mother was unaware of the amount of sugar she was ingesting or that her high sugar diet might be harmful. We propose that consideration could be made to including in routine antenatal advice that a high dietary sugar intake in late pregnancy could have the risk of causing harm to the baby, even in mothers not screened for or identified as having diabetes.

Unusual association of diseases/symptoms

Learning points
- Neonatal hyperinsulinism can cause profound and refractory hypoglycaemia with the potential for serious harm to the baby.
- In the symptomatic hypoglycaemic neonate it is important to establish normal blood glucose levels promptly to avoid short and long-term neurological complications.
- Neonatal hyperinsulinism is most commonly a transient phenomenon secondary to maternal diabetes. However, both transient and prolonged neonatal hyperinsulinaemic hypoglycaemia may occur secondary to a variety of pathologies, including in infants with no identifiable risk factors.
- It is well established that neonatal hyperinsulinism is associated with maternal diabetes but has not previously been linked with isolated high maternal sugar intake in pregnancy.

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REFERENCES
Case report

Use of intramuscular methadone in managing intravenous drug abuse

Edward Michael Bezant

SUMMARY

A 30-year-old woman was referred to the Acute Pain Team for their advice on how to manage her current pain, in light of her unique pre-admission medications. On questioning it was discovered that the patient was receiving 50 mg of intramuscular methadone daily, in the community. She was a former intravenous drug user who had been enrolled into a methadone substitution programme for 10 years and had been receiving her methadone intramuscularly for the past 6 years. It had been discovered that her addiction was not solely to opioids but, moreover, to the process of injecting as well. She was diagnosed with obsessive compulsive disorder, with a needle fixation, and started on the intramuscular methadone regimen on which she has maintained abstinence from heroin for 6 years.

BACKGROUND

Oral methadone replacement therapy is a widespread, mainstream treatment for heroin addiction. Methadone, being a long-acting μ-opioid agonist, with a half-life of 24–36 h, can prevent the withdrawal symptoms associated with abrupt heroin cessation, making cessation attempts more likely to be successful. Methadone tolerance and dependence frequently replace the heroin habit; however, this is deemed beneficial as repeated intravenous administration of an unsterile product, using unclean equipment and by untrained personnel, will likely result in blood borne virus transmission, abscess formation, septicemia and thrombosis. Furthermore, variations in the potency and the availability of illegally sourced opioids make overdose more likely. Therefore, dependence on a stable, oral dose of a long-acting opioid, such as methadone, remains preferable to an unpredictable and unclean heroin addiction.

Needle fixation can be defined as repetitive puncturing of the skin with or without the injection of psychoactive drugs (drugs that can produce mood changes and distorted perceptions) via intravenous, subcutaneous or intramuscular routes, irrespective of the drug or drugs injected or the anticipated effects of the drug.

CASE PRESENTATION

A 30-year-old Caucasian woman was referred to the Acute Pain Team following lower segment caesarean section of her sixth child by the staff responsible for her postnatal care. In addition to her postoperative pain, she had pre-existing sciatica that she had developed following a recent bout of pneumonia, which had forced her to sleep sitting up for a protracted period of time. The patient had been prescribed paracetamol and as it had shown little efficacy it had been withdrawn. The reason for the specialist referral was the patient’s pre-existing treatment with 50 mg of methadone intramuscularly, which encouraged the doctors responsible for her care to seek expert advice.

The patient had previously used heroin intravenously for a number of years and had attempted, unsuccessfully, to abstain for 4 years while on a methadone maintenance programme consisting of oral methadone. A member of the Community Drugs Team with a history of mental health identified that she displayed many of the hallmarks of obsessive compulsive disorder (OCD) such as intrusive, obsessional thoughts related to needles with associated anxiety and subsequent relief attained through completing injection-based compulsions. After formal investigation, the patient was given a diagnosis of OCD with needle fixation. While the patient herself retrospectively recognised many traits characteristic of OCD throughout her life, she did not suspect herself to suffer from OCD until the point of her formal diagnosis. At this point it was suggested that her heroin addiction could be separated into two separate addictions; one to opioids and one to compulsions relating to her needle fixation. Therefore it was decided that a trial to assess whether a regimen of long-term intramuscular methadone would simultaneously manage both of her addictions would be undertaken. Sterile needles and clinical grade methadone would minimise risks associated with repeated injections and would certainly outweigh the risks of continuing intravenous drug abuse. In addition to her history of heroin use, the patient reported a few isolated historical uses of intravenous crack cocaine over 5 years ago.

After her OCD was diagnosed, medical management of the condition failed, as due to the severe side effects of the medication, treatment was discontinued. Before her recently completed pregnancy, the patient reported that she had been enrolled in a cognitive–behavioural therapy (CBT) programme to treat her OCD, however, this was temporarily discontinued as it was deemed too stressful during her pregnancy. At the present time her anxiety issues are largely managed by her daily injections, which are associated with a ritual consisting of a certain method of preparation; lining up the ampules, drawing up the methadone and injecting it all personally. Notably, when as inpatient, she insisted on preparing and administering the injections herself and refused nursing assistance.

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Novel treatment (new drug/intervention; established drug/procedure in new situation)

TREATMENT
In addition to recognising the importance of continuing the patient’s baseline opioid and ‘needle requirements’ through her intramuscular methadone, the patient was prescribed further opioids, delivered through a patient controlled analgesia pump, to improve management of her immediate postnatal pain while she was in hospital.

DISCUSSION
Even though cases of concurrent opioid dependence and OCD with needle fixation are rare, this author could find no other literature detailing the use of long-term, intramuscular methadone maintenance therapy. Intramuscular methadone is manifestly inferior to oral methadone, in the long-term outpatient setting, due to the health risks inherent with repeated intramuscular injection and its failure to help patients escape their needle-centric behaviours; however, it would appear to be a novel way of combatting opioid dependence with concurrent needle fixation. In patients who would go on to have their OCD successfully managed by medication or CBT at some point in the future, intramuscular methadone could serve as a stepping stone to giving up needle centred compulsions and possibly substance misuse entirely.

In patients such as this, effective treatment of their OCD may be impossible if they are still dependent on illicit, injected opioids, as their use is frequently associated with an erratic lifestyle and poor compliance with treatments. Therefore, patients with a needle fixation, in whom heroin abstinence would aid their OCD treatment, may not find it possible to maintain their heroin abstinence aided purely by oral methadone, which would only treat their opioid addiction but not satisfy their compulsive needle behaviours.

However, it should be remembered that repeated self-administered, intramuscular injections carry risks such as abscesses, cellulitis, tissue necrosis, granulomas, muscle fibrosis, contractures, haematomas as well as accidental injury to vessels, bones and peripheral nerves.3

As methadone is a class A, schedule 2 controlled drug,4 it is subject to a number of legal regulations as well as specific guidelines for its use in substance misuse programmes. Since there is no documented precedent for the use of intramuscular methadone for the maintenance of heroin abstinence, this regimen poses a challenging question about the regulatory and legal foundation underlying this treatment. The guidelines released in 2007 by the Department of Health have a clear focus on avoiding the illegal diversion of controlled drugs from substance misuse programmes. However, this guidance also suggests that patients whose management with optimum oral methadone treatment fails can be considered, under specialist supervision, for injectable intravenous opioid maintenance treatment. Despite this, the Department of Health Guidance lacks mention of intramuscular methadone as a potential treatment. In their 2003 report on injectable methadone as a therapy for refractory heroin addiction, the National Treatment Agency concludes “there is a very limited clinical place for prescribing injectable methadone” and again makes no mention at all of intramuscular methadone.6

In conclusion, it is unlikely that intramuscular methadone will ever become a mainstream treatment for substance misuse programmes as it fails to part users from their needle-based behaviours in the way that oral methadone does, there is a greater risk of diversion for illicit use and there are significantly more medical complications from intramuscular administration than oral administration. However, in the very small subset of patients where heroin addiction and needle compulsions overlap, intramuscular methadone could remain a treatment of last resort; to be undertaken with intense supervision and as part of a multidisciplinary approach involving psychosocial, psychiatric and pharmacological interventions.

Learning points
► Needle fixing compulsions are possible and should be considered in intravenous drug users.
► Patients with pre-existing opioid requirements, from methadone maintenance, illicit drug use or chronic pain treatment, must have their baseline opioid requirements met in addition to any acute pain relief, if withdrawal is to be avoided.
► In patients where an obsessive compulsive disorder is a hindrance to their compliance with treatment, consider atypical treatments to best accommodate their specific requirements.

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