Personalised 3D-printed model of a chest-wall chondrosarcoma to enhance patient understanding of complex cardiothoracic surgery

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DESCRIPTION

Novel technologies, such as additive manufacturing (also termed three-dimensional (3D) printing), play an important role in surgical planning. Their role in enhancing a patient’s understanding of their medical condition and increasing their satisfaction with their treatment is also gaining increased attention in medicine and surgery. As an illustration, we describe the case of a 65-year-old Caucasian man who presented with left-sided anterior chest-wall pain which was associated with a visible palpable lump. He had a body mass index of 27 kg/m², and CT of the thorax demonstrated a 62 mm × 60 mm × 48 mm tumour involving multiple structures, including the left fourth to sixth ribs, costal cartilages and the pericardium overlaying the right ventricle (figure 1). Transthoracic echocardiography showed normal ventricular function without any indication of tumour infiltration into the myocardium.

Given the extensive involvement of neighbouring structures by this complex tumour, a 3D model was printed to enhance the patient’s understanding of his medical condition (figure 2). The model was able to be easily appreciated by the patient without requiring the interpretation of 2-D CT images; it also enhanced the patient’s understanding of the pathology and planned procedure. This played an important role in being able to provide informed consent for his surgery. The patient subsequently underwent a successful excision of the chondrosarcoma and an anterior chest wall reconstruction.

Our case highlights the role of 3D printing in complex thoracic surgery. With its increasing availability, 3D printing has seen a growing relevance across many surgical specialties by producing surgical guides, custom implants and anatomical models. In particular, it is useful in preoperative planning, especially in complex surgeries where a high degree of precision is required. This may, in turn, result in lower complication rates, improved patient outcomes and reduced hospital stays.

Advantages of 3D printing in aiding communication over conventional communication are not
At present, 3D printing is associated with an increased cost for procedures. However, 3D-printing modelling has been known to facilitate a more rapid understanding of anatomy compared with conventional media. It serves as a valuable tool of communication with patients and may be a useful resource in multidisciplinary team coordination for discussing the pathology involved in a surgical procedure. Further, uses of visual technologies such as 3D printing may help overcome hurdles arising from linguistic and cultural differences. Finally, although this modality remains in its infancy, current literature suggests improved outcomes in education compared with traditional educational methods.

With the continual implementation and enhancement of this technology, it is expected that 3D printing will play a significantly more prominent role in anatomical and surgical patient education in the future.

Learning points

► Three-dimensional (3D)-printing modelling is an effective tool for communication with patients, allowing a greater level of understanding and knowledge about their pathology.
► The use of 3D-printed anatomical models can be extended to the medical education arena for medical students and specialty trainees.
► This can allow healthcare providers to better visualise and consolidate anatomical pathology and maximise their learning.
► 3D-printing modelling allows more precise surgical planning, which may, in turn, lead to improved patient outcomes.

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