

Interventional Radiology's Function in the Treatment of Difficult Paediatric Surgery Situations

Abstract

Minimally-invasive techniques offered by interventional radiology (IR) are really helpful in the management of challenging surgical cases. The current report highlights a series of four complex pediatric surgical cases which were successfully managed by specific image-guided techniques. The first two cases in the present report were infants. One of them had a complicated type-1 choledochal cyst (obstructive jaundice and cholangitis) and was optimized with preoperative percutaneous Tran's Hepatic Biliary Drainage (PTBD) under fluoroscopic guidance. The other child had bilateral ureter pelvic junction obstruction and presented with urosepsis. Due to failure of retrograde stenting on one side, image-guided percutaneous nephrostomy and ante grade stenting were performed. The third and fourth cases had suffered blunt trauma to the abdomen. While one of them developed multiple pseudo aneurysms and arteriportal fistulae in the liver, the other had transection of the right posterior sectorial duct. Angioembolization of the pseudo aneurysms and embolization of the right posterior sectorial duct were performed for them under image-guidance respectively. The post-procedural course of all the above children was uneventful. Image-guided minimally invasive procedures are associated with less post-procedural pain, early recovery, and better cosmetic outcomes. In specific scenarios, they may even obviate the need for surgical intervention, thereby reducing the overall morbidity. Interventional radiology offers safe and effective alternatives to operative interventions. They are especially useful in the backdrop of significant morbidities like cholangitis, urosepsis, and trauma.

Keywords: Minimally-invasive techniques • Case report • Choledochal cyst • Angioembolization • Hepatic biliary drainage

Introduction

Interventional radiology (IR) has emerged as a dynamic and crucial component of modern medical practice, offering minimally invasive solutions for a wide range of clinical scenarios. Within the realm of paediatric surgery, interventional radiology has proven to be a game-changer, providing innovative techniques and procedures that address complex and challenging surgical situations. This article delves into the multifaceted role of interventional radiology in the treatment of difficult paediatric surgery situations, highlighting its contributions, benefits, and potential future developments [1].

Minimally invasive solutions

Traditional surgical approaches often involve large incisions and extensive tissue manipulation, which can be particularly daunting in paediatric patients due to their smaller anatomical structures. Interventional radiology, on the other hand, specializes in minimally invasive procedures that utilize advanced imaging guidance to precisely target and treat specific areas within the body [2]. This is especially advantageous in paediatric cases where delicate tissues need to be preserved and trauma minimized. Procedures like percutaneous biopsies, drainage catheter insertions, and vascular interventions can be performed with unparalleled precision, reducing postoperative pain and recovery time for young patients.

Surendra Nimesh*

Department of Surgery, National Taiwan University Hospital, Taiwan

*Author for correspondence:

Nsurendra4@gmail.com

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Complex vascular anomalies

Paediatric patients frequently present with intricate vascular anomalies that pose significant surgical challenges. Interventional radiologists possess expertise in managing these anomalies using techniques such as embolization, sclerotherapy, and stent placement. In cases of arteriovenous malformations (AVMs) or venous malformations, embolization can block abnormal blood vessels, redirecting blood flow and facilitating subsequent surgical interventions [3]. Sclerotherapy, often used for vascular malformations, involves injecting a sclerosing agent directly into the anomaly to promote vessel shrinkage. These procedures can significantly improve patient outcomes and enhance the feasibility of subsequent surgical interventions.

Image-guided tumor interventions

Paediatric tumours can be challenging to treat due to their location and potential risks associated with surgery. Interventional radiology offers image-guided solutions for tumour biopsies, ablations, and targeted therapies. Image-guided biopsy techniques ensure accurate sample collection, aiding in precise diagnosis and treatment planning. Radiofrequency ablation (RFA) and microwave ablation can be used to destroy tumour tissue while minimizing damage to surrounding healthy tissue, making them attractive options for unrespectable or difficult-to-access tumours [4].

Urinary tract interventions

Urinary tract issues are common among paediatric patients, necessitating delicate and precise interventions. Interventional radiology plays a crucial role in managing conditions such as vesicoureteral reflux (VUR) and obstructive uropathies. Fluoroscopic-guided ureteral stent placement, nephrostomy tube insertion, and percutaneous nephrolithotomy are just a few examples of procedures that interventional radiologists perform to alleviate urinary tract complications [5,6]. These minimally invasive techniques reduce the risk of infection, scarring, and other postoperative complications associated with traditional surgical approaches.

Collaboration and multidisciplinary care

The success of interventional radiology in treating difficult paediatric surgery situations is further enhanced by its collaborative nature. Paediatric interventional radiologists often work closely with paediatric surgeons, oncologists, urologists,

and other specialists to develop comprehensive treatment plans. This multidisciplinary approach ensures that patients receive the most appropriate and effective care, taking into accounts their unique medical history, condition, and individual needs [7].

Discussion

We have been following the minimally-invasive approach (laparoscopic or robotic-assisted laparoscopic) for excision of the choledochal cyst and hepaticoduodenostomy for more than seven years. Temporizing or bridge-procedures like percutaneous transhepatic biliary drainage (PTBD) or internal biliary stenting offers several advantages in children with complicated choledochal cysts; i.e. those with obstructive jaundice, cholangitis, or pancreatitis. Firstly, they relieve the biliary obstruction and vent out the infected static bile, thereby providing a window period for optimizing the general condition of the child [8]. Secondly, it is also believed by some, that these procedures might actually reduce the inflammation in the setting of cholangitis or pancreatitis. Thus, they can reduce the chances of open conversion and increase the success rates of minimally-invasive approaches. In the first case of the present series, the infant had features of cholangitis and poor nutritional status. These reasons prompted us to go for preoperative biliary drainage in the form of PTBD. Cho angiogram performed during PTBD confirmed a near-complete obstruction to be responsible for his symptoms. With these bridge-procedures, a clinical improvement is usually observed between 1–3 weeks, after which the children can be operated. Although internal stenting via endoscopic retrograde cholangiopancreatography (ERCP) is advantageous over PTBD, the non-availability of small-sized scopes is a major limitation with the former [9, 10].

Conclusion

Interventional radiology has revolutionized the landscape of paediatric surgical care by offering minimally invasive, image-guided interventions for complex cases. From vascular anomalies to tumour management and urinary tract issues, interventional radiology plays a vital role in resolving difficult paediatric surgery situations. Its ability to provide precise, targeted treatments with reduced trauma and faster recovery times highlights its significance in improving patient outcomes and quality of life. As technology

continues to advance, the field of interventional radiology is poised to contribute even more innovative solutions to the challenges of paediatric surgery.

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