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Review Article

Port site hernia in laparoscopic surgery: Mechanism, prevention and management

Mohan Venkatesh Pulle[*], *Rahul Siddhartha, Ashish Dey, Tarun Mittal, Vinod K. Malik*

Department of General & Laparoscopic Surgery, Sir Gangaram Hospital, New Delhi, India

ARTICLE INFO

Article history:
Received 16 April 2015
Accepted 28 May 2015
Available online 19 June 2015

Keywords:
Port site hernia
Laparoscopic surgery
Management

ABSTRACT

Port site hernia (PSH) is a rare type of incisional hernia occurring at port sites after laparoscopic surgery. Larger trocar size and improper port site sheath closure are considered to be the most important predisposing factors. In many instances, this condition may be overlooked due to short follow-up of the patients after surgery, and lack of knowledge of clinicians about this clinical entity. This article is aimed to review the applied surgical anatomy related to PSH and trocar placement and the gradual evolution in the design of trocars. Herein, we have also discussed the burden of the disease, techniques for prevention, diagnosis and management of PSH.

1. Introduction

Port site hernia (PSH) is an uncommon, potentially dangerous complication of laparoscopic surgery. Various etiological factors implicated are larger trocar size, midline ports, wound infection and improper closure of the sheath at port site. Appropriate port site closure is considered to be one of the most critical factors for prevention of PSH. The presentation can range from asymptomatic port site swelling to incarceration or strangulation of herniated contents. Management depends on timing of presentation of such hernia and merits prompt surgical intervention.

Laparoscopic surgery has gained rapid acceptance for a variety of surgical diseases worldwide. Although laparoscopic surgery has revolutionized the surgical milieu, it has its own risks and complications. PSH is one such specific complication of laparoscopic surgery which is often under-estimated due to multiple factors. PSH is a type of incisional hernia that occurs at port or trocar site after laparoscopic surgery. The first case reported on PSH was after gynaecological surgery.[1] However, the first case of PSH after laparoscopic cholecystectomy was reported in 1991.[2] This is a potentially serious complication leading to high morbidity as the small size of defect can incarcerate or strangulate the contents if bowel or part of it is present inside the sac.

1.1. *Applied surgical anatomy*

Understanding the surface anatomy of the abdominal wall is a pre-requisite for safe trocar placement in laparoscopic surgery. Knowledge of the layered structure of abdominal wall permits efficient and safe entry into peritoneal cavity.

* *Corresponding author.*
E-mail address: mohanvenkateshpulle@gmail.com (M.V. Pulle).
http://dx.doi.org/10.1016/j.cmrp.2015.05.008

Initially, there was controversy regarding use of umbilicus for first port access. The features favoring umbilicus are that it is the thinnest part of abdominal wall allowing easy access, the ability to hide scar marks resulting in better cosmesis, absence of large blood vessels and the fact that it is ergonomically better, it being the center point of abdomen. However the points of concern against the usage of umbilicus are, increased probability of umbilical port site infection as this area is occasionally unclean. Literature also suggests that umbilicus has the highest reported incidence of postoperative incisional or PSH.[3] Due to this, many surgeons now prefer to use either supraumbilical or infraumbilical region of abdominal wall for peritoneal access.

Umbilical PSHs are most common due to its inherent anatomical weakness.[3] The contents of the umbilical cord with embryological structures like allantois and vitelline duct are located in the inferior half of the umbilical orifice together with remnants of urachus and the round ligament. They help to protect this area from changes in intra-abdominal pressure. The superior part of umbilicus is however composed of thinner aponeurosis, covered by thinner transversalis fascia and therefore is prone for herniation. The ligament like structure from the linea alba to the umbilical cicatrix is described as umbilical pillar or umbilical stalk. Junction of the umbilical pillar with the linea alba is the thinnest part of the abdomen and at this point, the peritoneum is attached to the linea alba as a single layer. So this part is considered to be the most prone area for development of incisional umbilical hernia.[4] Port/Trocar sites placed away from midline are considered to be less prone for PSH due to overlapping of muscles and multiple fascial planes. It therefore has less propensity of dehiscence at these sites.

1.2. *Evolution in design of trocars*

Design of the tip of trocars is considered to be one of the critical factor for the pathogenesis of PSH. The tip design of the trocar is something that is constantly evolving. Interaction of surgeon and industry had resulted in better research & development with the benefit ultimately being passed on to the patients.

The term trocar is a derivation of the French term 'trios' meaning 'three', and 'carse' meaning 'edge'. Originally they were being used as a means of draining fluids or gases from the body. By the mid 18th century, urologists have begun to use trocars to guide surgical scopes into the bladder. Today, a very wide range of precision-engineered laparoscopic trocars exists, with instruments available in a variety of sizes and many different designs of the tip (Fig. 1). Most modern trocars comprise 3 primary components – cannula, seal and obturator. A cannula is a tube shaped shaft placed through the abdominal wall to allow access into the abdominal cavity. The seal is located at the top of cannula. The seal allows instruments to pass through the cannula while preventing air from escaping from the abdominal cavity. It maintains proper air pressure during laparoscopic procedure. The obturator is a mechanism that allows the cannula to penetrate the abdomen. There are several generations of trocars with modifications in the design of the tip. First generation trocars had a pyramidal tip with sharp cutting edges (Fig. 2). They

Fig. 1 – Various trocars used in laparoscopic surgery.

divide the muscle fibers along their tract and therefore carry a high risk of port site bleeding and postoperative PSH. The next generation trocars were disposable shielded trocars with spring-loaded mechanisms. Normally, the shield covers the sharp tip of trocar but when it encounters resistance through abdominal wall, the shield partially retracts and exposes the sharp tip. As the shield enters the abdominal cavity, it springs forward again to cover the tip (Figs. 3 and 4). The trocars were intended to prevent the sharp tip from injuring the intra-abdominal contents.

With the better understanding of the pathogenesis of trocar site hernia, another variety of trocars have been designed-the bladeless, conical tip, dilating trocars. The dilatation can be radial or axial. The dilating trocars have been shown to create a smaller abdominal port diameter compared with the bladed trocar.[5,6] These devices enter the peritoneal cavity by splitting the muscle fibers rather than cutting them.[7] Inserting 10–12 mm non bladed trocars will produce defects less than 6–8 mm in diameter.[8] The Radially Expanding Access System consists of a 1.9 mm veress needle surrounded by an expanding polymeric sleeve. Abdomen is first insufflated with veress needle. The needle is removed and the remaining sleeve acts as a guide/tract through which the abdominal wall can be dilated upto 12 mm by using an obturator (conical tip) by twisting movement (Fig. 5).

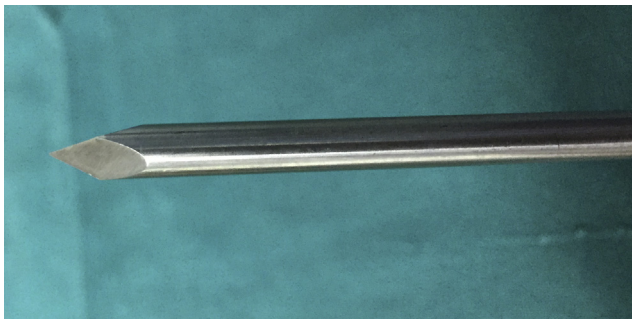

Fig. 2 – Pyramidal tip (bladed) trocar.