

SELF-RETAINING RETRACTORS FOR ABDOMINAL SURGERY

¹CHANCHAL GUPTA, ²LALIT MOHAN SAINI, ³RASHMI SAINI

¹National Institute of Technology, Kurukshetra, Haryana, India

²School of Biomedical Engineering

³Swami Dayanad Hospital, New Delhi, India

E-mail: ¹111chanchalgupta@gmail.com, ²lmsaini@nitkkr.ac.in, ³rashmisaini.nk@gmail.com

Abstract - Intra-operative damage due to sharp ended retractors and infection at the incision site due to bacterial invasion are the complications faced by the surgeons during abdominal surgery leading to high morbidity. The plastic sheath self-retaining retractor reduces the risk of surgical site infections to a great extent. It also enhances the performance of abdominal surgeries as second assistant is not required at the operating table providing more freedom of movement to the surgeon. The aim of this study is to compare the plastic sheath retractors with reinforced O-rings and various metal retractors in context with the surgical site infections and other intra-operative damages.

Keywords - Self-Retaining Retractor; Abdominal Wall; Caesarean Section; Surgical Site Infection; Ratchet System; Intraoperative Damage; Tamponade Effect.

I. INTRODUCTION

At times a second assistant may not be available, and even if one is present, one must hold the instrument against an unyielding rib cage. This quasi-static position cannot be maintained for too long an interval and as a consequence, frequent annoying shifting of the appliance results. Also, especially in obese patients, the relatively short arms of the retractor do not permit adequate visualization in the depths of the wound.

Self-retaining retractor permits surgery to proceed without the presence of second assistants, allowing for less crowding at the operating table. This device frees the assistants from retractor holding chores and instead makes them available for other jobs such as aid in exposure, homeostasis, closure, and other intra-operative technical functions that help the surgeon

Among the types of retractors are metal type and plastic sheath type retractors. In metal retractors, stainless steel is generally used for retraction as it is strongest material and can be sterilized and reused. The plastic sheath retractors are used both as effective retractors as well as wound protectors. The advantages of self-retaining retractors are continuous adequate exposure, decreased risk of infection, lessened number of assistants with increased efficiency as the concentration will now be on the surgery rather on the retraction.

II. METAL TYPE SELF-RETAINING RETRACTORS

A. BOOKWALTER RETRACTORS

The Bookwalter retractor is a tool that surgeons use to separate or hold back the ends of a surgical incision, with the abdomen or chest being the most common sites. Self-retraction is achieved by applying tensile force on the retracted tissues through multiple blades. Fig.1 shows the Bookwalter retractor.



Fig.1: Bookwalter retractor

It is made up of steel. It varies in size according to the thickness or toughness of the organs or tissue that need to be pushed aside. The sizes include 2 by 3 inches (51 by 76 mm), 2 by 4 inches (51 mm by 10.1 cm), 2 by 5 inches (51 mm by 12.7 cm), and 2 by 6 inches (51 mm by 15.2 cm).

The Bookwalter abdominal retractor is versatile in blade positioning and thus provides optimum exposure for abdominal operations.

B. BALFOUR RETRACTOR

Unlike other retractors using patient's body mass for holding the position of retractor, the Balfour retractor uses the ratchet system in which blades are attached to the frame as shown in Fig.2. In this way, this retractor opens the incision, and keeps the underlying muscles and tissues away from obstruction during the operation.



Fig.2: Balfour retractor

The disadvantage of this retractor is that it uses only three blades making it sometimes insufficient for holding out the muscles and tissues. As it is employed with ratchet system, the depth of blade is fixed. So the surgeon may need to use another retractor, again for which second assistant is required. The advantages of this retractor include holding out the deep structures in obese patients and giving optimum retraction to the peritoneum. It is used for longer surgeries which require retraction for longer duration [7].

Although these retractors are more versatile, they have disadvantage that the blades can't be repositioned with respect to the frame.

C. COLLIN RETRACTOR

The material used for Collins retractor is polished stainless steel. It also uses ratchet system for retraction. The peritoneum is held apart by the holding blades. The blades first spindle and then come to rest position against the abdominal wall. Fig.3 shows the Collin retractor.



Fig.3: Collin retractor

This retractor is disadvantageous due to increased obstruction from bowel, skin lacerations and subcutaneous fat layers [1].

D. LONE STAR RETRACTOR

The self-retaining Lone Star retractor system is a completely flexible comprehensive system. The system is composed of retractor rings and elastic stays that provide optimal exposure and access to the surgical site.

Retractor rings are available in both disposable plastic and reusable stainless steel and aluminium models. Available in a wide array of retractor ring shapes and stay hook types, the system provides a multitude of options for making surgery simpler.

In addition, the surgeon may retract tissue from any desired angle by repositioning or adding elastic stay hooks [5]. Fig.4 shows the disposable and lightweight plastic Lone Star retractor.

The lightweight retractor rings articulate to rapidly adjust to surgical needs on demand. The versatile combination of elastic hooks and retractor rings provides maximum exposure and increased visibility.

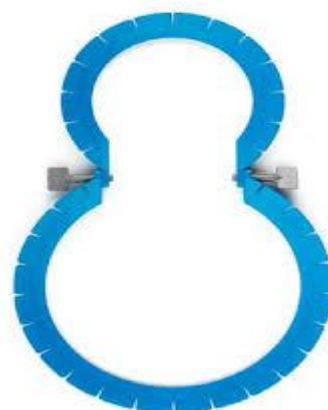


Fig.4: Disposable Lone Star retractor

To get an effective result it is important that the retractor applies uniform tension on the skin flaps. Precaution should be taken while removing stay hooks; because, they have sharp ends.

III. DRAWBACKS OF METAL RETRACTORS

Main key factors of efficient retractors include simpler functioning and expanded exposure. For using the metal self-retaining retractors, the amount of tensile force applied to the bowel, and other organs should be considered.

The disadvantages of these retractors is their sharp tips, which can be harmful to important soft tissues, such as nerves and blood vessels.

The use of retractor may attribute to intraoperative damage to other organs which further leads to major postoperative complications. There is a high risk of intra-abdominal scar formation. It causes damage to the colon and femoral nerve. Femoral neuropathy and colon injuries are the common injuries. Intraoperatively, lesions in the colon may occur due to the tension of the retractor blade despite being padded with sponges [11].

The retractor may also damage renal vein causing renal vein thrombosis in which formation of clot occurs in the vein that drains blood from the kidneys, ultimately leading to a reduction in the drainage of one or both kidneys and the possible migration of the clot to other parts of the body.

The retractor may also attribute to distended abdomen, rising leukocytes, rising C-reactive protein. It may also lead to peritonitis due to perforation of the cecum [2].

IV. PLASTIC TYPE SELF-RETAINING RETRACTOR

The plastic type retractor is a disposable self-retaining retractor. It is used both as wound protector and an effective retractor.

This type of retractor is placed inside the abdomen during surgery and the advantage of this retractor is that it can be placed inside the abdomen with a small

incision. This retractor comprises of a polythene sheath with plastic rings at its both the ends. The inner ring is flexible that's why it can be placed easily around the field of incision which then expands outward in the abdomen and takes the circular shape retracting the underlying organs. Outer ring is comparatively rigid which remains outside the abdomen.

ALEXIS RETRACTOR

The Alexis retractor is designed for abdominal surgeries and specifically for cesarean delivery to allow the passage of the neonate while still providing retraction and wound protective properties. It reduces the rate of Surgical Site Infections (SSI) and postoperative wound disruptions.

The retractor is a tubular device with a flexible ring on each end joined by a plastic sheath, providing circumferential retraction and wound protection to the abdominal wall edges during surgery. The retractor is placed after making the peritoneal incision. The internal ring of the retractor is placed inside the peritoneum, and the outer ring is rolled until the plastic barrier between the rings became taut. The retractor is then checked to ensure that there is no inadvertent trapping of intra-abdominal contents [8]. It provides 360 degree circular retraction with a simultaneous tamponade (no bleeding) effect. Fig.5 shows the plastic sheath type Alexis retractor.



Fig.5: Alexis retractor

With the use of Alexis retractor there is a significant reduction in the bacterial wound infection and thus decreasing the rate of surgical site infections during abdominal surgeries, possibly through a mechanism of decreasing bacterial colonization of the abdominal wall edges.

Alexis retractor is not preferred with the patients having repeated surgery in the same region; because of adhesive disease. Generally, it is preferred for first caesarean section operation. Scar tissues between two organs cause them to adhere to each other. Therefore,

Alexis retractor is not preferred for second caesarean operation.

ADVANTAGES OF PLASTIC SHEATH RETRACTORS

The method of retraction plays a vital role in the risk of infection at the surgical site. An infection can occur at the site of surgery due to the use of retractors. Sepsis is a major reason of mortality.

Plastic-sheath retractors reduce surgical site infections in many ways.

These retractors cover the tissues intra-operatively and thus prevent healthy tissues from getting contaminated by blood, fetal tissues, microorganisms and other surgical manipulations. Also it attributes to tamponade effect which results in lesser amount of bleeding and better hemostasis. Since bleeding is less, therefore, the need of electrocautery for blood stoppage is limited [1].

The plastic sheath retractor enables wide exposure, and applies uniform retraction on the abdominal. Along with reducing the risk of infection, the plastic sheath retractors have various advantages over the metal retractors. They are as follows-

- There is a need for continuous suction and removing out the blood clots with the metal retractors. Since the plastic sheath retractors covers the surrounding walls, therefore, there is less blood loss and thus reduction in the need of suction during the operation.
- There is a reduction in the need for diathermy. Less use of diathermy leads to less infarcted tissues and debris.
- It is easy to use and remove the retractor.
- The metal retractors may produce asymmetrical and sometimes excessive traction. This may result in hematomas and postoperative pain. This postoperative pain is reduced to a great extent with the plastic retractor, thus, reducing the morphine intake [3].
- There is better exposure and fewer crowds at the operating table. This provides the surgeon with more freedom of movement at the operating table.
- Morbidity is less.
- Feasible, safe and efficient technique.
- They significantly reduce post-operative ileus i.e., less abdominal cramps, nausea, bloating, vomiting and constipation.
- They also reduce time to return to normal diet, ICU and overall hospital stay.
- Facilitates earlier return to normal diet and proper bowel functions [11].

Type of retractor	Material used	Ease in placement and removal	Reflective under light	Wound infection	Disposable or Reusable
Bookwalter	Metal	Difficult in both	Yes	High SSI	Reusable
Balfour	Metal	Difficult in both	Yes	High SSI	Reusable
Lone Star	Metal or	Difficult to	Metal-Yes	Low SSI	Metal-Reusable

Type of retractor	Material used	Ease in placement and removal	Reflective under light	Wound infection	Disposable or Reusable
	plastic	remove	Plastic-No		Plastic-Disposable
Collin	Metal	Difficult in both	Yes	High SSI	Reusable
Alexis	Plastic	Easy in both	No	Minor	Disposable

Table 1: COMPARISON OF RETRACTORS

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