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HOW-I-DO-IT

Intraoperative hypertonic saline irrigation preventing seroma formation and reducing drain secretion in extended endoscopic hernia and linea alba reconstruction glue

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Abstract

Purpose Subcutaneous Seroma formation (SF) is commonly seen after abdominal wall Hernia surgeries and reconstructive surgeries due to large dissecting dead space and is associated with increased morbidity. SF is common particularly after big abdominal wall hernia repairs and its treatment can be challenging and long. Current prevention methods are not consistent and the treatment includes repeated aspirations and drains, both are associated with higher risk for infections. The purpose of this article is to present a novel and simple technique of Intraoperative Hypertonic Saline Irrigation (IHSI) to abdominal wall subcutaneous large dead space, which prevent postoperative SF and enables early drain removal due to reduced secretions.

Methods Eight patients undergone the Extended Endoscopic Hernia & Linea Alba Reconstruction Glue surgery (eEHLARglue), for Ventral Hernias (VH) and Rectus Muscles Separation (RMS). An extensive Endoscopic 450cm^2 dissection free surface of the anterior Rectus fascia, is performed prior to Hernia dissection and closing of the RMS. It is followed by onlay mesh placing over the repaired Rectus muscles and the mesh is fused into the muscles by Fibrin Glue. The novel preventive method is based on Intraoperative Irrigation of the vast cavity through the two 10 mm JP closed system drains with 20 cc of NaCl 12% left at site for 10 min.

Results Our early results with all our patients show seroma prevention, lower secretion rate of 20 cc in 10 h and drain removal within 20–24 h.

Conclusions IHSI enhance adhesion formation and reduce secretion rate in wide subcutaneous dissection space like in eEHLARglue, therefore enables early drain removal and prevent SF. As a result, reducing overall morbidity and hospitalization period, decreasing inconveniency and cost saving of multiple outpatient visits or additional surgery. This simple technique could be used in other potential postoperative SF surgeries. Further larger study with a longer follow up is advised.

Keywords Hypertonic Saline · Sclerosant · Drain irrigation · Intraoperative · Seroma · Abdominal wall · Ventral and umbilical hernia · Rectus muscles separation · Diastasis rectaii · Extended endoscopic hernia and linea alba reconstruction glue

Abbreviations

IHSI	Intraoperative hypertonic saline irrigation
HS	Hypertonic saline
SF	Seroma formation
eEHLARglue	Extended endoscopic hernia and linea alba reconstruction glue
RMS	Rectus muscles separation
VH	Ventral hernia

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Introduction

Postoperative Seroma is commonly seen after many operations and several factors are involved in its pathophysiology [1]. Large dissection causing a big dead space is a risk factor for fluid accumulation and a formation of a postoperative Seroma. Postoperative subcutaneous seromas are seen in high prevalence after very commonly performed surgeries,

mainly reconstructive surgeries. In breast surgeries, a post mastectomy seroma is reported to have an incidence of 3% to more than 90% [2-4]. Breast reconstruction can be either alloplastic or autologous and carry a high risk for SF. A prevalence of 2-20% was reported in implant based breast reconstructions and in 10% of cases after breast reconstruction using lipofilled latissimus dorsi flap [5]. After a breast reconstruction using DIEP free flap, a prevalence of 2.8-4% is reported for seroma formation in the abdominal wall [6]. Liposuction and Abdominoplasties are commonly performed by plastic surgeons after massive weight loss. Postoperative seromas after liposuctions are reported to occur in 5% of the cases [7], While after abdominoplasties, the prevalence of seroma formation t is ranging from 5–43% [8]. Postoperative Seromas is also frequently seen after big Abdominal Wall Hernia and RMS repairs due to a wide subcutaneous space dissection. An incidence of 35% and 46% of seromas diagnosed clinically were reported in patients undergone Laparoscopic repair of incisional hernia and ventral hernia, accordingly [9, 10].

Seromas may be challenging to manage at times and may persist for several months or even years [11]. Complications of postoperative Seroma vary from delayed wound healing, repeated seroma aspirations with the risk of infection, prolonged hospital stay, skin flap necrosis, patient discomfort, repeated visits to the outpatient clinic, delay in commencing adjuvant therapies when needed and higher surgical expenditures if additional surgery is needed, although it is usually resolve conservatively [12]. Preventive measures for SF include application of pressure dressings, quilting sutures, meticulous control of bleeding, sealing agents including fibrin glue and negative pressure using drains, and are all not consistent and seroma may continue to form [13-16]. Drains are recently falling out of favor due to evidence that support their use is limited and associated with postoperative infection [16, 17]. No report in the literature was found for using IHSI as a preventive measure for subcutaneous SF or for early drain removal.

Methods

Our experience is based on the prevention of abdominal wall SF after eEHLARglue surgery for Ventral Hernia (VH) with significantly big Rectus Muscles Separation (RMS) [18, 19]. This Endoscopic surgery incorporate extensive subcutaneous dissection, creating a space of 15 × 30cm, meaning a very large dead space of 450 cm^2. Therefore, it holds a very high risk for seroma formation and that is what motivated us to develop an intraoperative preventive measure for SF.

We use the Lap. Sitting Position (LSP) setup (Fig. 1), as previously described by us [20, 21], for the eEHLARglue that enables excellent positioning and instruments approach.

Fig. 1 Lap Siting Position - LSP for eEHLARglue surgery

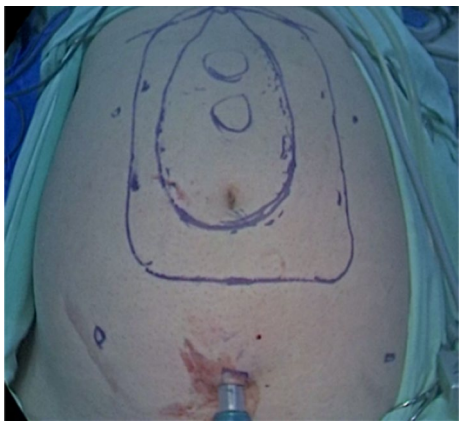

Fig. 2 Skin Outline marking of: Hernias, RMS, Subcutaneous dissection space

External outline marking of the hernias, RMS, subcutaneous dissection space is performed (Fig. 2). Endoscopic penetration is done at the suprapubic area by Opti-view 11 mm and two 5 mm trocars. Extensive 15X30cm Endoscopic dissection of the sub-cutaneous fat tissue from the Anterior Rectus Fascia is performed by monopolar scissors and Ligasure with the assisting of 17 cm Hg CO2 gas pressure. Dissection progresses up to the Xiphoid, laterally to the Costal margin and 7 cm away from each side of the Rectus muscles separation line. Any Hernia sac is dissected, and the content is reduced back to the abdominal cavity (Fig. 3)

Relaxing Incisions of the Anterior Rectus Fascia are performed by monopolar hook longitudinally, in both lateral aspects (Fig. 4). The RMS is closed by two running rows of 1/0 nonabsorbable V- lock sutures plications: 1st row plicate the loos Linea Alba (Fig. 5), and the 2nd plicate the Anterior Rectus Fascia over it (Fig. 6) a New Linea Alba is reconstructed. A light Prolen Soft Mesh 30X15cm is introduced as dual-scrolls, placed onlay over the central line repaired Rectus Muscles and spread

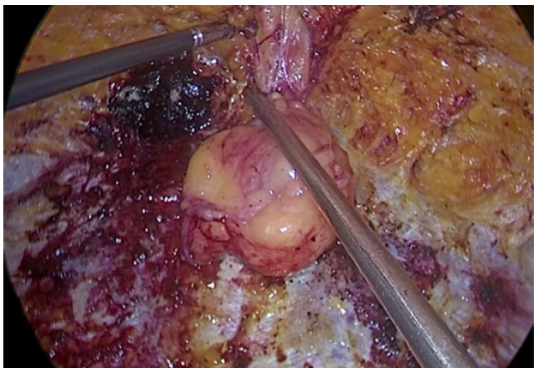

Fig. 3 Hernia contents dissected and reduced back to the abdominal cavity

Fig. 4 Bilateral Rectus sheet relaxing excision

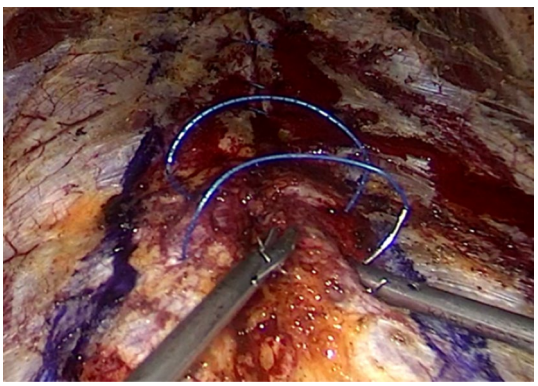

Fig. 5 1[ST] row running suture from Xiphoidal to Pubic duplicating the loos Linea Alba

irrigating with 4 + 4 cc Fibrin Glue all over the mesh area is performed for achieving immediate homogeneous fusion of the mesh surface to the muscles, and hemostasis (Fig. 7). Two 10 mm Jackson-Pratt closed system drains are inserted through the bottom 5 mm trocars skin port cuts (Fig. 8).

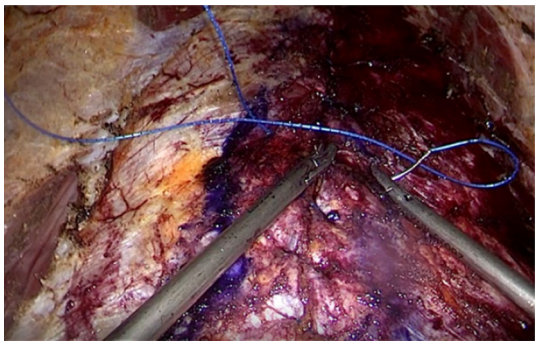

Fig. 6 2[nd] row running suture placating the Anterior Rectus Sheet over the re-build LA

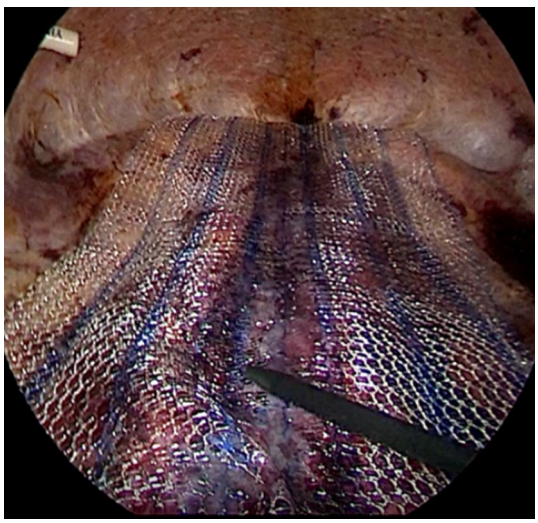

Fig. 7 All Onlay Mesh surface is fused to the muscles by Fibrin Glue

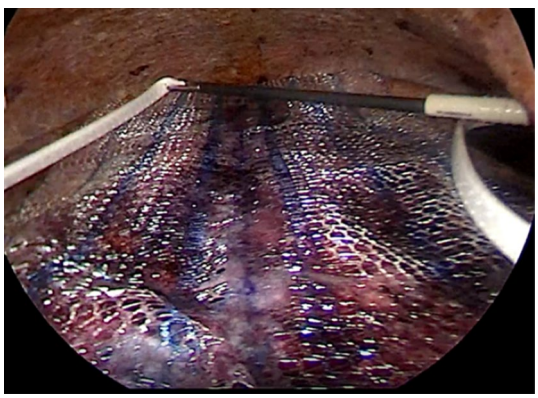

Fig. 8 Two closed system JP drains are placed inside the cavity

Our novel and simple method of IHSI includes: At the end of the surgery, irrigating the developed cavity with HS 12% NaCl (Fig. 9). Through each of the two drains (Fig. 10),

Fig. 9-11 IHSI Method: 10 cc of 12%NaCl is injected to each of the two drains (total 20 cc), left for 10 min

10 cc of NaCl 12% (Total 20 cc) are injected and left in place for 10 min before connecting the vacuum chambers (Fig. 11). An abdominal girdle is wrapped on the OR table and used for 3 months postoperatively.

Results

We developed a novel and simple preventive method of IHSI to a large subcutaneous surgical dissected space in our eEHLARglue surgery for VH and RMS. We applied the IHSI method on eight patients, five women and three men, age 33–60 years treated for significant RMS combined with VH. Only two patients had only umbilical hernia, and the other 6 presented with combined umbilical and epigastric, 3 of which was a recurrent hernia. The range of Width/Length of the RMS defect was 5/27–9/22 cm with area of 135–198cm2. The total dissected area was 585–648 cm2 and after the repairing of the Hernia and the RMS defect, the subcutaneous mesh area was 450 cm^2, Table 1.

Clear serosanguineous secretions were reduced in volume rapidly, on the same day of surgery to a secretion rate of 20 cc in 10 h. All our patients had the drains removed within 20–24 h postoperatively. The patients were discharged from the hospital in the first day post-surgery.

We performed a firm clinical follow up of five months postoperatively, given that seromas are formed in the early postoperative period usually during the first month, and the chance of seroma formation later than three months postoperatively is extremely rare. Sonographic examination of seroma post hernia repair demonstrated that it is typically present after the third or fourth postoperative day, and its incidence peaks at the seventh postoperative day [22]. Therefore, we believe that five months follow up period is acceptable. In these five months we did a firm clinical follow up of every 3 weeks. We had no cases of clinical SF post eEHLARglue surgery in any of our patients and no case of recurrence. In no case there was a clinical indication for performing a CT scan study.

Table 1 Patients undergone eEHLARglue surgery with IHSI prevention method of SF

Age	Gender	Hernia type	RMS width and length cm	RMS area cm^2	Total dissection size cm^2	Mesh subcutaneous area cm^2
51	Female	Recurrent epigastric + umbilical hernia	24×6	144	594	450
60	Male	epigastric + Reccurent umbilical hernia	26×6	156	606	450
44	Female	Umbilical + epigastric hernia	22×7	154	604	450
36	Female	Umbilical + epigastric hernia	20×9	180	630	450
39	Female	Umbilical hernia	22×6	132	582	450
33	FEMALE	Large epigastric + umbilical hernia	22×9	198	648	450
54	Male	Reccurent epigastric + umbilical hernia	22×6	132	582	450
34	Male	Umbilical hernia	27×5	135	585	450

Presenting our IHSI method in recent congress, we got positive feedback from our colleagues who used our IHSI technique and had similar very early results [23].

Discussion

We experienced two prior complicated cases of big SF following eEHLARglue surgery in overweigh men with large RMS in combination with Epigastric and Umbilical Hernia, one of which was a recurrent one. We treated both cases with extensive drainage and decided to additionally irrigate the cavity through the inserted drain with Hypertonic Saline 10%. Due to successful results in managing the SF, we have come to think going one step ahead with a method that will prevent the postoperative SF using the same HS.

One of the methods to treat postoperative SF is injection of a sclerosant. Sclerotherapy involves filling the seroma cavity with an irritating substance, which induces a fibrotic response needed to seal the dead space. Different sclerotherapies were reported; Talc, Antibiotics like Tetracycline and Erythromycin, Ethanol, Polidocanol, Fibrin glue or a combination therapy with partial success [11]. Hypertonic Saline known to be a potent sclerosant agent stimulating apoptosis, fibrosis and adhesion formation [24]. The use of Hypertonic Saline (HS) was only sporadically reported in the past for the treatment of fluid collections, for ablation of hepatic hydatid cyst cavity [25] and for ablation of reticular and telangiectatic leg veins [26]. As a treatment for postoperative SF, we were able to detect in the literature only one citation as a single experience in a letter to the editor in 2003 by Gruver [27]. No report in the literature was found for using IHSI as a preventive measure for SF or for early drain removal. Based on our previous success with treating PO subcutaneous SF by HS, we developed our novel and simple preventive method for postoperative SF by IHSI to the big subcutaneous surgical cavity developed in our Extended Endoscopic Hernia & Linea Alba Reconstruction Glue surgery (eEHLARglue). This surgery includes an extensive subcutaneous dissection space of 450cm^2 and prone to develop a PO subcutaneous SF, is an ideal surgery for using and testing the efficiency of the new IHSI technique.

IHSI stimulate fibrosis and adhesion formation and therefore decreases drain secretions volume and rate. The strong sclerosant irritating effect of 20 cc of 12% Hypertonic NaCl, induced immediate reaction in the subcutaneous dissected tissue surface. The space remain hold collapsed by the abdominal girdle and rapidly fibrotic adhesions are formed. This effect resulting in preventing seroma formation and enables a short period of drain usage reducing drain complications. Particularly in surgery prone to developing SF due to extensive subcutaneous dissection. Postoperative seromas are very common, can be challenging to manage and carry a risk for additional comorbidities, repeated aspirations, infections and even additional surgery. IHSI, a simple method to perform, can therefore reduce complications and costs due to a shorter hospitalization and a decreased amount of aspirations in outpatient visits. Currently, we were not able to find a proven preventing measure for SF in the literature for this common complication and our IHSI method could be a real solution. It was developed for our eEHLARglue which includes an extensive subcutaneous dissection space and can be applied in all AWH repair and other surgeries involving vast dissection area with a higher risk for subcutaneous SF.

Summary

IHSI to a large dissected subcutaneous surgical dead space Prevent a very common and disturbing surgical complication, postoperative SF. IHSI act as a sclerosant that stimulate immediately the subcutaneous tissue for adhesions formation and reduces secretion rate. We demonstrated that applying the IHSI technique for dissected large subcutaneous dead space will enable early drain removal avoiding drain related complications and prevention of PO SF. This simple method can reduce patients' and surgeons' inconveniency, hospitalization period, outpatient visits and costs. The IHSI method can be used in all AWH and other potential SF surgeries. Further study with a larger sample size and a longer follow up period will be needed.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Approval from the institutional review board was not required for this study.

Human and animal rights The study including Human participants has been performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent All of the patients signed in advance an informed consent.

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