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Review Article

Techniques of mesh fixation in laparoscopic ventral hernia repair: the surgical enigma - a review

Jitendra Kumar[1]*, Rajni Raina[2]

[1]Department of Surgery, Lady Hardinge Medical College and Smt. S.K. Hospital, New Delhi, India
[2]Department of Anaesthesia, Dr B.S.A. Medical College and Hospital, Rohini, New Delhi, India

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***Correspondence:**
Dr. Jitendra Kumar,
E-mail: jkumar33@ymail.com

ABSTRACT

Fixation of mesh in laparoscopic ventral hernia repair is most important step of surgery. But till date, we have not been able to reach on an any universal consensus in respect of finding any gold standard or at least so called, one ideal technique of mesh fixation. Aim of this study is to find out best or at least most appropriate technique of mesh fixation if any, on the basis of thoroughgoing of all the related literature available on line. An extensive search of literature was performed using online search engines like Google, PubMed etc. In an attempt to find all the available method of fixation technique and reports in terms of their efficacy and surgical outcome, all the related studies from the inception of laparoscopic ventral hernia surgery have been analyzed. Among all the articles we analyzed, maximum number [two RCT's, three review's article, four case series/retrospective studies, one prospective study of large case series, one animal study] reported in direct favors of trans fascial suture. Four reports [one RCT, one case control study, one case series and one review article] found to be having result in direct favour of tacker fixation of mesh in laparoscopic ventral hernia repair. Two other reports find no difference in Sutures and Tack. On the basis of our result, among all the techniques of mesh fixation available today, trans fascial suturing technique of mesh fixation seems to be the best. Main drawback with this is consumption of more operating time.

Keywords: Laparoscopic ventral hernia, Mesh fixation, Surgical fixation devices, Lap hernia repair, Suture versus tacks

INTRODUCTION

Fixation of mesh is most significant step of surgery in laparoscopic ventral hernia repair. Since the inception of laparoscopic ventral hernia repair, techniques of mesh fixation over the abdominal wall defects have been the topic of huge debate. It is not only a matter of personal convenience but may influence the various outcomes of the surgery. In spite of that, we are far away from reaching near any universal consensus on this issue.[1]

Laparoscopic ventral hernia repair was first described in 1992 by Karl Leblanc, who performed the surgery using four to five port and all repairs were made using 1-mm-thick expanded polytetrafluoroethylene patches inserted intraperitoneally and stapled to the anterior abdominal wall over the defects, making use of intra-abdominal pressure to secure the repair.[2] Since then, a lot of different techniques by different surgeons are being used for fixation of mesh. Main factors determining surgeon's preference are minimizing mesh migration and recurrences. Other factors are surgeon's convenience, time duration, post-operative pain and seroma formation.

With time, so many options of anchoring and gluing devices have flooded the market by different commercial establishment. But one question always remains that which one is really appropriate and cost effective. Nowadays, widely practiced technique of mesh fixation in LVHR is, in which, the mesh is fixed circumferentially

with staples or tacks and anchored with trans fascial stay sutures placed at the four cardinal points of the graft. Majority of reports come up in favor of this traditional technique.[3,4] But at the same time several studies have come up with the equally good result with tacker only fixation.[5,6]

METHODS

For this review article, in an attempt to find all the available method of fixation technique and reports related to them we scanned all the related material, so far available online. An extensive search of literature was performed using online search engines like google, PubMed, etc. All the related studies from the inception of laparoscopic ventral hernia surgery till date (March 2016) have been analyzed. Initially about '112' related studies were collected, out of which, finally we found '49' studies eligible for further analysis.

Criterion for inclusion of these article was anything specific and evidence based input, in respect of techniques of mesh fixation in laparoscopic ventral hernia repair so that we would be able to find out overall outcome of these different techniques in respect of surgeon's comfort, operative time, intra operative and post-operative complications, post-operative pain, seroma, quality of life of patient and recurrence of hernia. And after the analysis of all these outcomes, we tried to find out most appropriate technique if any, of mesh fixation in LVHR.

DISCUSSION

Primary aim of fixation of mesh in laparoscopic ventral hernia repair is prevention of mesh migration and reduce complication like recurrence and postoperative pain.[7] Currently so many different techniques are being used to fix a mesh during laparoscopic repair.[8,9] Among all these techniques, Tack or staple and suture, either alone or in combination are most commonly used. [10-13] Now so many type of tacker devices using either non absorbable metallic helical tacks or absorbable permanent screw fasteners have flooded the market. All of them claim superiority over each other.

Other newer techniques which are still at experimental stage are Fibrin sealant or tissue glue, barbed anchor sutures, T anchor, Salute Q ring (Onus Medical).[14-20] Mitek anchor are also being used at the places where fixation to bony structure are required for e.g.- near costal cartilage and pelvis.[21,22] An experiment of laser assisted tissue welding for solder fixation of mesh to peritoneum has also been successful with no statistical difference noted between stapled and soldered mesh in animal model.[23] In addition to all of these, a concept of self-adhering meshes also came in to the picture but in respect of LVHR, it is still at an experimental stage.[24]

In practice, commonly used fixation devices are non-absorbable tacks, absorbable tacks, sutures and another technique currently evolving is fibrin/tissue glue.

Tacks are applied to fix the mesh over the abdominal wall via a mechanical device called the tacker. Tacks are found to cause potential damage to mesh at site of fixation.[25] During earlier days, only non-absorbable variety of tack was available and with time a lot of complications like more pain, adhesions and perforations of small bowel and even cardiac tamponade been reported and attributed to it.[26,27]

Then absorbable tacks entered the market with claim of less post-operative pain, adhesions as well as other fixation related complications. They are better compatible with light weight meshes. There are few studies in respect of use of absorbable tack with light weight mesh, which reported similar surgical outcome in comparison to non-absorbable tack.[28-30] While another study reports higher risk of recurrence with absorbable tack than non-absorbable tacks.[31] However, it will be too early to make any inference out of these as these are observational studies on small series of patients.

Since the beginning, trans fascial suturing of the mesh to fix it on abdominal wall is considered important and an unavoidable step. Lot of studies reported in its favor, that this is the only way to secure adequate fixation strength and durability which is the basis to prevent recurrence.[4,32-35] One study reported that the tensile strength of transabdominal sutures is up to 2.5 times greater than the tensile strength of tackers.[36] In contrast to some serious complications reported with use of tacks, only few cases of hernia through trans-fascial suture site has been reported and attributed probably to technical error.[37,38] This is the reason why, even today majority of surgeons along with tacks fixation, use four corner trans fascial suturing.

Till date, huge trend of suture vs tack issue continued and number of study published in support of each other. A group finds favorable result for suture only fixation in terms of its cost effectiveness, stronger fixation strength which may minimize recurrences, early recovery, reduce early post-operative pain and less shrinkage of mesh.[39,40] Another group finds equally good or even better result for tacker only but in the form of double crowning technique of fixation.[41-44] Report which favors the combination of tack and suture fixation claim that the combination method affords the advantage of maximum fixation strength and reduced operative time compared to suture or tack fixation only.[4,32-34] Some studies did not find any significant difference between suture and tack fixation technique in terms of recurrence rate and other surgical outcome. Moreover, one of them finds more infection rate when trans fascial suturing was used for mesh fixation.[45,46]

In an attempt to find an ideal technique for mesh fixation another method in the form of tissue glue is evolving. These are fibrin sealant/glue basically combination of fibrinogen and thrombin of human plasma and another one is synthetic glue (N-butyl-cyanoacrylate-glubran 2). Most of the studies in term of their efficacy and surgical outcome has been done on animal model.[47] In all of these study it has been found promising and comparable to other fixation techniques. There is one randomized controlled double blind study, done on patient of umbilical hernia with follow up of one year reported positive result in favor of fibrin glue. But in larger hernia defect (>5cm) recurrence rate was much higher so it does not recommend its use in hernia with larger (>5cm) defect size.[48]

Apart from above mentioned techniques of mesh fixation, a lot of other techniques are not worth mentioning here as they are either in experimental stage or being used in certain specific demanding situations e.g.-Mitek bone anchor.

Among all the studies included in this topic, about fourteen studies were published on account of experience gained out of case series in retrospective manner.[1-6,10,11,21,22,29,32,33,43] There were nine review article and seven randomized control trial.[7-9,12-15,30,35,39,40,41,44,45,47,48] We found seven relevant case reports also, most of which reported either some unusual complications due to particular mesh fixation technique or some innovative idea of mesh fixation technique.[17,19,26,27,37,38,49] A few prospective cohort and case control studies also found to be very helpful.[28,31,34,42,46,47] Rest of the studies, most of which were done at experimental level on animals included an attempt to evaluate newer technique of mesh fixation e.g.-fibrin sealant, tissue glue, Laser fixation etc.[16,18,20,24,25,36]

At the end of thorough going, if one technique which gets the maximum favorable outcomes in terms of good surgical outcome as well as less complications, is the trans fascial suture technique of mesh fixation. Among the all reports mentioned here, eleven reports (two RCT's, three review articles, four case series/retrospective studies, one prospective study of large case series, one animal study on pig cadaver reported in direct favors of trans fascial suturing.[4,11-13,32-36,39,40] At the same time certain report came out against the use of tack in terms of either complication caused by it, or evidence of the potential damage of the mesh because of the tack and high recurrence rate following use of absorbable tacker.[25-27,31,49] Although two case reports were found, which reported post-operative hernia through trans fascial suture hole, which was considered more as a situational and technical fault rather than of the technique itself.[37,38]

Among the all reviewed article scanned here, only four reports (one RCT, one case control study, one case series and one review article) were found to have result in direct favor of tacker fixation of mesh in laparoscopic ventral hernia repair.[41-44] Two other reports (one prospective study and another review article) find no difference in recurrence rate and other surgical outcome.[45,46] One of the review study reported increased rate of infection following the use of trans fascial suture for mesh fixation.[45]

Fibrin sealant/tissue glue has started being used sparingly for mesh fixation in laparoscopic inguinal hernia surgery and a lot of favorable reports have started coming up. But as already mentioned, use in laparoscopic ventral hernia is still at experimental stage and a lot of further study in larger series of patients with long term follow up is required. As far as all other techniques are concerned, they have started evolving but it is too early to comment upon them.

CONCLUSION

In spite of significant edge of suture fixation over tacks in term of fixation strength, economy and better surgical outcome, still it is not considered a gold standard and tacker using permanent tack is being used primarily for mesh fixation. Simple reason for this is, suturing consumes a lot more operating time and further, needs better technical skills and experience. Another factor may be commercially driven that makes the companies market their product aggressively.

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