Non-absorbable sutures are associated with lower recurrence rates in laparoscopic percutaneous inguinal hernia ligation

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Summary

Introduction
Laparoscopic hernia repair with percutaneous ligation of the patent processes vaginalis is a minimally invasive alternative to open inguinal herniorrhaphy in children. With the camera port concealed at the umbilicus, this technique offers an excellent cosmetic result. It is also faster than the traditional laparoscopic repair with no differences in complication rates or hospital stay. The goal of this study was to describe a series of consecutive patients, emphasizing the impact of suture materials (absorbable vs. non-absorbable) on hernia recurrences.

Methods
A retrospective review was performed of consecutive transperitoneal laparoscopic subcutaneous ligations of a symptomatic hernia and/or communicating hydrocele by 4 surgeons. Patients > Tanner 2 or with prior hernia repair were excluded. The success of the procedure and number of sutures used was compared between cases performed with absorbable vs. non-absorbable suture. Risk factors for surgical failure (age, weight, number of sutures used, suture type) were assessed with logistic regression.

Results
94 patients underwent laparoscopic percutaneous hernia ligation at a mean age of 4.9 years. Outcomes in 85 (90%) patients with 97 hernia repairs at a mean of 8 months after surgery revealed 26% polyglactin vs 4% polyester recurrences (p = 0.004) which occurred at mean of 3.6 months after surgery, Table 1. Repairs performed with non-absorbable suture required only 1 suture more often than those performed with absorbable suture (76% vs 60%, p = 0.163). Logistic regression revealed suture type was an independent predictor for failure (p = 0.017). Weight (p = 0.249), age (p = 0.055), and number of sutures (p = 0.469) were not significantly associated with recurrent hernia.

Discussion
Our review of consecutive hernia repairs using the single port percutaneous ligation revealed a significantly higher recurrent hernia rate with absorbable (26%) versus non-absorbable (4%) suture. This finding remained significant in a logistic regression model irregardless of number of sutures placed, age, and weight. Though the authors acknowledge the drawback of the potential for learning curve to confound our data, we still feel these findings are clinically important as this analysis of outcomes has changed our surgical practice as now all providers involved perform this procedure with exclusively non-absorbable suture. We thus suggest that surgeons who perform this technique, especially those newly adopting it, use non-absorbable suture for optimal patient outcomes.

Conclusions
Recurrent hernia after laparoscopic percutaneous hernia ligation was significantly lower in repairs performed with non-absorbable suture. Based on this data, we recommend the use of non-absorbable suture during laparoscopic ligation of inguinal hernias in children.

Keywords
Laparoscopy; Hernia; Inguinal; Hydrocele

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Introduction

In the pediatric population, laparoscopic inguinal hernia repair is a minimally invasive alternative to open inguinal herniorrhaphy. Previously published meta-analyses have reported similar outcomes with a laparoscopic approach to that with a standard open repair, with ≤4% having recurrent hernias [1]. Although a laparoscopic approach has been associated with a longer operative time when compared to an open repair, the advantages of an endoscopic technique include the ability to easily evaluate the contralateral internal ring and a reduced risk of metachronous hernia [1].

In addition to laparoscopic hernia repair, with division or ligation of the sac using three laparoscopic instruments, a minimally invasive hernia repair can also be accomplished with percutaneous suture ligation without additional laparoscopic ports, other than a 3 mm or 5 mm camera, via the subcutaneous endoscopically assisted ligation (SEAL) technique [2]. This approach involves high ligation of the patent processus at the internal ring within a groin incision or dissection of the vas and spermatic vessels [2]. With the camera port concealed at the umbilicus, this technique offers an excellent cosmetic result with virtually invisible incisions.

Initial reports indicate low rates of recurrent hernia (0.5–4%) after SEAL hernia ligation [3–5]. As with the three-port laparoscopic technique, percutaneous ligation has also been shown to reduce the risk of metachronous hernia when compared with open repair [6]. Besides the cosmetic advantage, percutaneous ligation is also faster than the traditional laparoscopic repair and there are no differences in complication rates or hospital stay [7]. Previous reports have also indicated that the risk factors for recurrent hernia after this technique include: single purse-string ligation versus double ligation, and hernia ring defects >2.5 cm [5,7]. The type of suture (absorbable vs non-absorbable) was not associated with recurrences [3].

At the time of initial adoption of this SEAL technique by the present institution, a majority of cases were performed with absorbable sutures (2-0 polyglactin). However, after reviewing the initial outcomes and noting what seemed to be a larger than expected number of recurrent hernias, practice patterns were changed, and by the end of the study period all of the involved providers were using non-absorbable sutures. Continuous variables were compared with unpaired t-tests. As the secondary objective was to assess for potential risk factors for failure of hernia repair, the specific risk factors for surgical failure (patient age, patient weight, number of sutures used, and suture type) were also assessed with logistic regression performed with STATA® 11 (StataCorp LP, 4905 Lakeway Drive, College Station, Texas 77845-4512, USA). An alpha of <0.05 was considered statistically significant. As this was a retrospective study, no power analysis was performed.

Laparoscopic hernia repair technique

The laparoscopic percutaneous hernia ligation was performed with the same technique by all surgeons and was similar to the SEAL technique previously described [3]. After administration of general anesthesia the patient was placed in a supine position. A 3-mm or 5-mm incision was made at the umbilicus, and a 3-mm or 5-mm port was placed for a zero degree laparoscopic camera. Both sides of the internal ring were visualized and both sides of the scrotum were examined to ensure that the contralateral side did not insufflate. On the side of the hernia, a 2-mm stab incision was made on the lateral border of the internal ring and subcutaneous tissues were spread with a fine hemostat. A 2-0 polyglactin or polyester suture on a CT-1 needle was preperitoneally passed around the internal ring under direct vision, passing on top of the spermatic vessels and the vas. Ninety five percent of the needle was brought out through the skin medial to the internal ring. The back of the needle was then passed under the skin and out of the initial stab incision. The suture was tied and intra-operative success was declared if there was visual occlusion of the hernia, plus lack of insufflation of the ipsilateral scrotum (which signified no further communication with the peritoneal cavity). If the hernia still appeared to be open or there was continued scrotal insufflation, another suture was placed with the technique described above. Patients were awoken from anesthesia and discharged home after adequate recovery in the post-anesthesia care unit. Patients were seen in the office for a post-operative visit and physical exam approximately 6 weeks and then 6 months after the original procedure.

Materials and methods

Study design and population

After IRB approval, a retrospective review was performed of a prospectively collected database, which included all prepubertal patients who underwent transperitoneal laparoscopic subcutaneous ligation of a symptomatic hernia and/or communicating hydrocele at a single institution from 9/1/2011 to 5/1/2013 by four surgeons. Patients were excluded if they had previously undergone open or laparoscopic hernia repair or other inguinal surgery, or who were Tanner stage 2 or higher. The data reviewed included: age at surgery, patient weight, type and number of sutures used, surgical outcome, and complications. Success of the procedure was defined as clinical resolution of hernia, as documented by the surgeon at a post-operative evaluation.
Results

One hundred and seven percutaneous laparoscopic hernia ligations were performed on 94 patients during the study period (81 unilateral, 13 bilateral). The mean age at surgery was 4.9 years. All patients were male. Of the bilateral inguinal hernia repairs, six were diagnosed prior to the surgery, six were discovered and repaired at the time of repair of the contralateral side, and one was metachronous. The mean number of sutures required for the hernia repair was 1.4 (1–4). All procedures were laparoscopically performed, with no conversions to an open procedure. All patients were discharged home on the day of surgery.

Nine patients (10%) were lost to follow-up. For the remaining 85 patients who underwent a total of 97 hernia repairs, at a mean follow-up of 7.9 months (1.2–33.4) after surgery, the overall success for the procedure was 85% (82/97). When comparing the success of absorbable versus non-absorbable sutures there were 13/50 (26%) absorbable recurrences versus 2/47 (4%) absorbable recurrences versus 2/47 (4%) non-absorbable recurrences ($P = 0.004$ (Table 1). The recurrences occurred at a median of 2.2 months (0.6–17.5) in the absorbable suture group versus 5.2 months (2.7–9.8) in the non-absorbable suture cohort. Repairs performed with non-absorbable sutures required only one suture more often than those performed with absorbable suture (76% versus 60%, respectively) but this difference was not statistically significant ($P = 0.163$ (Table 1). In addition, there was no statistically significant difference in patient age or weight at the time of hernia repair between the absorbable and non-absorbable suture groups (Table 1). The length of follow-up was significantly longer in the absorbable suture group (Table 1).

Logistic regression revealed that suture type ($P = 0.007$) was an independent predictor of failure for laparoscopic hernia ligation (Table 2). Patient weight ($P = 0.249$), patient age ($P = 0.055$), and number of sutures used for ligation ($P = 0.469$) were not significantly associated with failure of the procedure.

There were five acute complications: three non-reducible hydroceles, one wound infection, and one needle breaking whilst in the patient, which was extracted at the time of the procedure. There were no injuries noted to any intra-abdominal organs or large vessels. All complications occurred in the absorbable suture group. The difference in complications between groups (11% vs 0%) was not statistically significant ($P = 0.057$ (Table 1). All hernia recurrences were successfully treated with open inguinal hernia repair.

Discussion

Percutaneous endoscopic inguinal hernia ligation in children offers many advantages over traditional open-port or three-port laparoscopic hernia repairs, including: improved cosmesis, shorter operative times, ability to examine the contralateral ring, reduced risk of metachronous hernia, and lack of dissection of the vas and spermatic vessels [6–8]. Previously reported risk factors for recurrent hernia include use of only one ligation suture and large hernia defects [5,7]. The present review of consecutive hernia repairs using the single-port percutaneous ligation or SEAL technique revealed a significantly higher recurrent hernia rate in cases that used absorbable (26%) versus non-absorbable (4%) suture for ligation of the patent processus vaginalis. This finding remained significant in a logistic regression model, regardless of the number of sutures placed, patient age, and patient weight.

Very few comparisons have been made between the successes of SEAL hernia repairs with absorbable versus non-absorbable sutures. Ozgediz et al. described 300 hernia repairs and found no differences in hernia recurrences between procedures performed with absorbable compared with non-absorbable sutures — 5% versus 3.8%, respectively [3]. The majority of other large series describing SEAL hernia repairs only used non-absorbable sutures and reported failure rates ranging from 0.5 to 0.9% [4,5]. In contrast, series that used absorbable sutures reported a higher failure rate of 4.8% [7]. Furthermore, Bharathi et al. commented in their discussion that "early dissolution of absorbable thread before the obliteration of the patency of the sac” may have contributed to the increased rate of recurrent hernias in their series [7].

A study of the SEAL technique for laparoscopic hernia repair in rabbits performed with absorbable sutures found a 100% hernia recurrence rate after the sutures were cut

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<th>Table 1</th>
<th>Outcomes of absorbable vs non-absorbable sutures.</th>
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<td>Absorbable suture ($n = 50$)</td>
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<tr>
<td>Mean age, years (SD)</td>
<td>5.1 (3.7)</td>
</tr>
<tr>
<td>Mean weight, kg (SD)</td>
<td>21.8 (14.6)</td>
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<tr>
<td>One suture closure, n (%)</td>
<td>34 (76%)</td>
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<tr>
<td>Mean follow-up, months (SD)</td>
<td>10.4 (7.9)</td>
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<tr>
<td>Complications, n (%)</td>
<td>5 (11%)</td>
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<tr>
<td>Recurrences, n (%)</td>
<td>13 (26%)</td>
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<th>Table 2</th>
<th>Logistic regression: risk factors for recurrent hernia.</th>
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<tr>
<td></td>
<td>$P$-value</td>
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<tr>
<td>Age</td>
<td>0.055</td>
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<tr>
<td>Weight</td>
<td>0.249</td>
</tr>
<tr>
<td>Number of sutures</td>
<td>0.469</td>
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<tr>
<td>Suture type</td>
<td>0.017</td>
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12 weeks after the initial repair [9]. To prevent hernia recurrence, this suggests that this technique relies heavily on the sutures staying intact. Blatnik et al. also found that inciting slight peritoneal trauma prior to the repair resulted in a reduced number of recurrent hernias [9]. Therefore, they suggested using permanent sutures and possibly even braided sutures, which may increase inflammation and possibly improve the strength of the repair [9]. Similar findings have been reported in three-port laparoscopic hernia repairs in humans, with absorbable sutures noted to not hold as long, and their use was felt to contribute to an increased rate of hernia recurrences [10].

It could be argued that the longer period of follow-up in the present absorbable-suture group may have contributed to the increased rate of recurrent hernias in this cohort. While this is a possibility, it is unlikely, as the mean follow-up in the non-absorbable group was 6.9 months, which is an adequate time for formation of a recurrence, as the literature has previously documented that the majority of failures after this technique occur within 2–6 months [3,5]. It also makes clinical sense that if the hypothesis is that the hernia repair fails as soon as the absorbable sutures dissolve, then a majority of failures would be seen around 6–8 weeks, as polyglactin sutures dissolve between 42 and 63 days [11].

It was also noted that the non-absorbable suture cohort required more than one suture ligation less often than the absorbable suture group; however, this difference was not significant with Fisher’s exact test or on logistic regression. It is possible that the increased number of ligations may have been performed in the absorbable cohort because they were performed earlier in the series; therefore, the surgeons may have felt more comfortable with the single suture technique as they became more proficient with the repair. This confounder of ‘learning curve’ may have also contributed to the increased number of failures in the absorbable suture group. Although this drawback is acknowledged, it is felt that these findings are clinically important, especially in light of the other studies suggesting increased hernia recurrence after absorbable suture repair [7,9,10]. It may be that the combination of learning curve and absorbable sutures resulted in the very high number of recurrent hernias, which further emphasizes that surgeons who are looking to adopt this technique should do so with non-absorbable sutures.

Advantages to this study include: prospective data recording, use of different suture types by the same surgeons, and logistic regression for the evaluation of risk factors for recurrent hernia. Downfalls of this study include: the non-randomized nature, the bias of a potential ‘learning curve’ for the procedure, the lack of measurement of the size of the hernia defect at the time of the procedure, and loss to follow-up of 10% of patients. Regardless of these factors, this analysis of outcomes has changed current surgical practice, as all of the involved providers now exclusively perform this procedure with non-absorbable sutures. It is suggested that surgeons who perform this technique, especially those who are considering adopting it, use non-absorbable sutures for optimal patient outcomes.

Conclusions

Contrary to previous reports, recurrent hernia after laparoscopic subcutaneous hernia ligation was significantly lower in repairs performed with non-absorbable sutures, but not associated with the number of sutures placed. Based on this data, it is recommended that non-absorbable sutures be used during laparoscopic percutaneous inguinal hernia ligation in children.

Conflict of interest statement

None declared.

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References

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