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Review

Open mesh versus suture repair of umbilical hernia: Meta-analysis of randomized controlled trials

Donna Shrestha[a], Alice Shrestha[b], Badri Shrestha[c,*]

[a] North Manchester General Hospital, Manchester, United Kingdom
[b] Parkview Surgery, Stockport, United Kingdom
[c] Northern General Hospital, Sheffield, United Kingdom

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ABSTRACT

Background: The optimal methodology of surgical treatment of umbilical hernia in adults remains controversial. Previously published randomized controlled trials (RCTs) and cohort studies have demonstrated advantage for open mesh over suture repair. Two published meta-analyses, including RCTs and retrospective cohort studies, have compared the outcomes of open mesh versus suture repair of umbilical hernia in adult, which were flawed since they included both elective and emergency repairs of umbilical hernias. The aim of this meta-analysis is to include RCTs to examine whether open mesh repair of umbilical hernia produces a better outcome than suture repair in adult patients.

Methods: A literature search using Medline, Embase and Cochrane Database was performed, and meta-analysis was performed using RevMan 5.3.5 software. Outcomes evaluated incidence of hernia recurrence, wound infection, haematoma, seroma and patient death.

Results: Of the 620 records identified, 4 RCTs, including 620 patients, were included in the meta-analysis. In the RCTS, when open mesh repair was compared with suture repair, open mesh repair was associated with significantly low incidence of recurrence (odds ratio (OR) 0.22, 95% confidence interval (CI) 0.10–0.48; P = 0.0001). The incidence of wound infection (OR 0.89, 95% CI 0.35–2.31; P = 0.82), haematoma (OR 0.83, 95% CI 0.28–2.41; P = 0.73), and seroma (OR 2.01, 95% CI 0.82–4.91; P = 0.13), were similar between the two groups.

Conclusions: Open mesh repair was associated with significant reduction in the recurrence rate in comparison to suture repair of umbilical hernia.

1. Introduction

A midline abdominal wall defect from 3 cm above to 3 cm below the umbilicus is termed as umbilical hernia [1], which has the global prevalence of 2% [2]. Symptomatic or clinically apparent umbilical hernias are repaired surgically by suture repair or use of mesh. Although 5–10% of patients are re-operated for recurrence, many more have clinically detectable recurrence with risk of chronic pain [3]. The use of mesh has proven to be beneficial in incisional and inguinal hernia repair, and mesh repair has become gold standard repair in both types of hernias [4,5]. However, the technique of elective surgical repair of umbilical hernia in adults using suture or mesh has been heavily debated and the reported complication rates related to both methods of repair differ from one study to another [6,7].

Two previously published meta-analyses [8,9] including 3 randomized controlled trials (RCTs) [10–12] had shown significant reduction in the recurrence rate using mesh compared to the suture repair. Wound-related complications such as bleeding, infection, haematoma and seroma were similar between the two groups. However, the meta-analyses were flawed by inclusion of 1 RCT that had included patients admitted as emergency with incarcerated and recurrent paraumbilical hernias, including a patient who required bowel resection. There was heterogeneity in between the studies implying significant risk of bias and low level of evidence. Two recently published RCTs have examined the outcomes of suture and open mesh repair of umbilical hernias including large number of patients [2,13]. The aim of this meta-analysis is to examine the outcomes of elective suture versus open mesh repair of umbilical hernias in adults by including RCTs published up to date.

* Corresponding author. Northern General Hospital Herries Road, Sheffield, S5 7AU, United Kingdom.
E-mail address: shresthabm@doctors.net.uk (B. Shrestha).

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2. Methods

2.1. Literature search strategy

A systematic electronic literature search was performed in PubMed (1949–March 2018), EMBASE (1974–March 2018) and Cochrane Library databases. The search terms “umbilical hernia”, “mesh repair”, “suture repair”, “recurrence” and “outcomes”, were used. There was no language restriction. All articles relevant to umbilical hernia repair were identified, reference lists of relevant studies were further scrutinised for additional citations and all pertinent references were compiled in the EndNote software (Version X 7.4; Thomson Reuters, Philadelphia, PA, USA).

2.2. Literature screening

The authors independently screened the titles and abstract of the records identified in the electronic searches, excluding all studies not meeting the inclusion criteria as described below. Full texts of all potential studies were examined. Any discrepancies in eligibility judgements were resolved by discussion between the authors.

Clinical question structured in PICOM format: Is open mesh repair of umbilical hernia associated with improved outcomes compared to suture repair?

Population: Adult patients over the age of 18, who had elective umbilical hernia repair.

Intervention: Open mesh repair of umbilical hernia.

Comparator: Suture repair of umbilical hernia.

Outcomes: Recurrences, wound infection, haematoma, seroma and patient death.

Methods: Randomized controlled trials.

2.3. Inclusion and exclusion criteria

RCTs which described one or more of the following outcome measures including recurrences, wound infection, haematoma, seroma and patient death were included in the meta-analysis. Duplicate publications and those which did not conform to the PICOM format were excluded.

2.4. Data extraction and critical appraisal

The level of evidence of individual study was assessed using Oxford Centre of Evidence-Based Medicine - Level of Evidence document [14]. Quality and potential for bias of the RCTs was evaluated using the Cochrane Collaboration's tool for assessing risk of bias by Higgins [15]. The work has been reported in line with AMSTAR (Assessing the methodological quality of systematic review) Guidelines (Supplementary file 1) [16].

2.5. Statistical methods

The meta-analysis was performed using RevMan 5.3.5 software (Nordic Cochrane Centre, The Cochrane Collaboration, 2014). Heterogeneity of treatment effects between studies was assessed using the Q (heterogeneity Chi square (χ^2)) and the I^2 statistics. I^2 of > 50% indicated significant heterogeneity in the studies, and in this situation a random effects model was used. For homogeneous studies, a fixed effects model and the Mantel–Haenszel method for calculation was adopted. For smaller event rates (0–1), Peto method was applied. For dichotomous outcomes, we reported results as an odds ratio (OR), while reporting continuous outcomes, weighted mean difference (WMD) was used. Summary estimates and 95% confidence intervals were calculated. Overall effects were determined by the using Z-test. $P < 0.005$ was considered significant. Forest plots were drawn based on these results. The minimum number of studies considered appropriate for display of forest plot was two [17]. Finally, the quality of each conclusion was assessed by the GRADE tool (GRADEpro GDT, Cochrane Community, UK) [18].

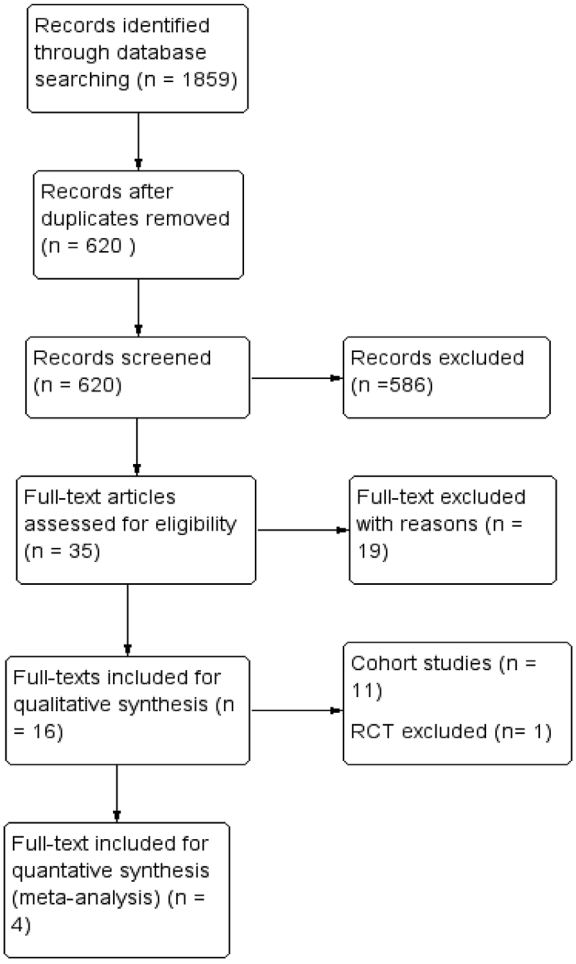


Fig. 1. PRISMA flow diagram of the systematic literature search.

3. Results

3.1. Search results

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) flow diagram is presented in Fig. 1. The search identified 5 RCTs. One RCT was excluded as the study included patients who had emergency repair of recurrent umbilical hernias and bowel resection. Four RCTs including 620 patients were included in the meta-analysis which compared the outcomes of open mesh with suture repair (Table 1).

3.2. Study quality

Four RCTs [2,10,11,13], which met PICOM criteria comparing open mesh with suture repair of umbilical hernia, were included in the meta-analysis. All 4 studies showed low risk of bias (Table 2).

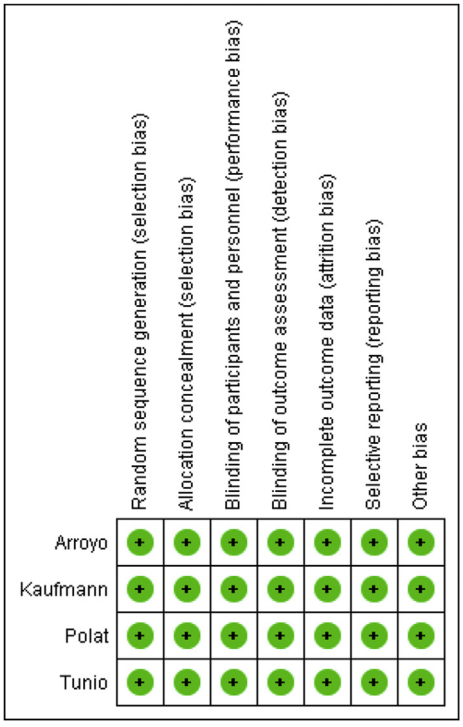
3.3. Outcomes

Four RCTs [2,10,11,13] included in the meta-analysis, with a total of 620 patients, compared the outcomes of open mesh and suture repair of umbilical hernias. The methods employed for repair and follow-up periods in each study group are shown in Table 1. Open mesh repair

Table 1
Studies included in the meta-analysis showing the techniques of repair and follow-ups.

Authors	Year	Country	Repair groups	Numbers	Follow-up (months)	Repair techniques
Kaufmann [2]	2018	Netherlands	Suture	138	25.1 (median)	Interrupted or continuous Prolene (O) sutures placed in transverse direction
			Mesh	146		Bard Mesh or Prolene mesh placed in the preperitoneal space
Tunio [13]	2017	Pakistan	Suture	43	36	Mayo repair (Double breasting with Prolene (1) suture
			Mesh	43		Onlay Prolene mesh repair
Polat [11]	2005	Turkey	Suture	18	22 (mean)	Mayo repair
			Mesh	32		Prolene hernia system and onlay Prolene mesh repair
Arroyo [10]	2001	Spain	Suture	100	64 (mean)	Interrupted polyester sutures
			Mesh	100		Prolene mesh placed in extraperitoneal space (mesh plug for up to 3 cm defects and mesh sheet for larger defects)

Table 2
Risk bias assessment of 4 RCTs showing low risk.



was associated with significantly low incidence of recurrence (odds ratio (OR) 0.22, 95% confidence interval (CI) 0.10–0.48; P = 0.0001) (Fig. 2A). The incidence of wound infection (OR 0.89, 95% CI 0.35–2.31; P = 0.82) (Fig. 2B), haematoma (OR 0.83, 95% CI 0.28–2.41; P = 0.73) (Fig. 2C), and seroma (OR 2.01, 95% CI 0.82–4.91; P = 0.13) (Fig. 2D), were similar between the two groups. There was no reported death in either groups.

4. Discussion

This meta-analysis of RCTs has shown open mesh repair of umbilical hernia in adult was associated with significant reduction of recurrence compared with suture repair. The risk of wound infection and haematoma was similar between the two groups. However, the risk of seroma formation was higher following open mesh repair compared with suture repair (4.3% vs.2.3%), although the difference was not statistically significant. All 4 RCTs included in the meta-analysis have low risk of bias and there was no heterogeneity observed.

Kaufmann et al. have recently published the outcomes of a double-blind, multicentre RCT investigated the usefulness of the mesh in reducing recurrence compared with suture repair for smaller umbilical hernias of diameter between 1 and 4 cm in adult patients. Of the 300 patients recruited (150 in each group), 12 patients in the suture group and 4 patients in the mesh repair group were excluded because of insufficient data, withdrawal of consent after surgery, erroneous diagnosis of the type of hernia and loss to follow-up. They observed fewer recurrences in mesh group than in the suture group (4% vs. 12%). The recurrence occurred in suture group earlier than patients treated with mesh; with the onset of recurrence being 3.6 months in suture repair group versus 12.6 months in mesh repair group. The 2-year actuarial estimate of recurrence was 3.6% vs. 11.4% (hazard ratio 0.31, 95% CI 0.12–0.80; P = 0.01). The post-operative complications such as wound infection (2% vs. 1%), haematoma (2% vs. 1%) and seroma (3% vs.1%) were not significantly different. There were no anaesthetic complications or patient deaths [2].

Arroyo et al., in a RCT compared the results of open mesh and suture repair of umbilical hernia. They observed significantly higher rate of recurrences after suture repair compared with open mesh repair (11% vs. 1%; P = 0.0015). The incidence of wound infection, haematoma and seroma were similar in two groups [10].

Polat et al. compared the outcomes of open mesh and suture repair of umbilical hernia in a RCT and observed no recurrence following mesh repair compared with 11% recurrences after suture repair. The incidence of wound infection, haematoma and seroma were similar between the two groups [11].

Similarly, Tunio et al., in a RCT observed increase in the recurrence rate after suture repair compared with open mesh repair. The analgesic requirement and hospital stay were lower in the mesh repair group. However, more seroma occurred after mesh repair [13].

Increasing number of laparoscopic mesh repair are being carried out for umbilical hernias because of the benefit conferred such early return to work, shortened hospital stay and reduced incidence of recurrences [19]. A recently published meta-analysis including 3 RCTs and 7 retrospective cohort studies enrolling a total of 16,549 patients showed laparoscopic mesh repair was associated with significant reduction in the recurrence rate, duration of hospital stay, wound dehiscence and wound infection. There was no difference in the haematoma and seroma formation between the two groups [20]. However, the studies included in the meta-analysis had significant selection bias, thereby provided a low level of evidence. Eleven retrospective cohort studies including 2533 patients (mesh repair = 855; suture repair = 1678) showed significantly low incidence of recurrence after open mesh repair [6,7,21–29]. Although the number of RCTs included in the study is limited to four, the analysis of data on 620 patients has shown low risk of heterogeneity and bias, thereby provide a high level of evidence. On assessment of the grades of evidence for each outcome measures using the GRADE tool (GRADEpro GDT, Cochrane Community, UK), the observed evidence belonged to high quality (Supplementary file 2) [18].

5. Conclusions

The results observed from RCTs suggest that open mesh repair is associated with reduced risk of recurrence without added risk of wound

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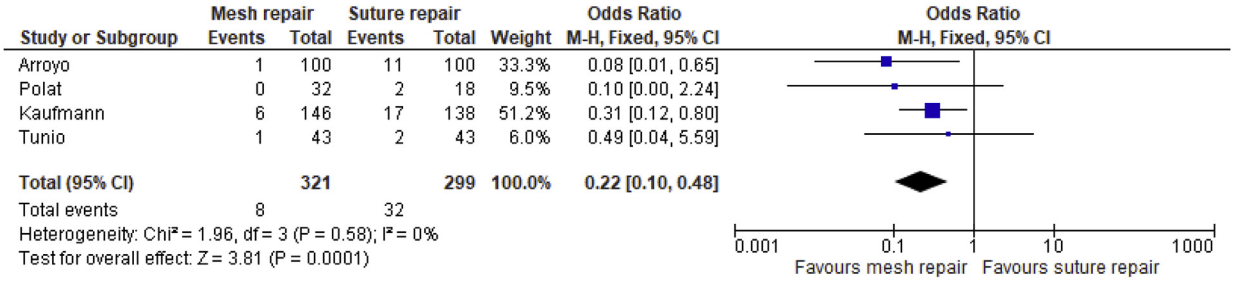

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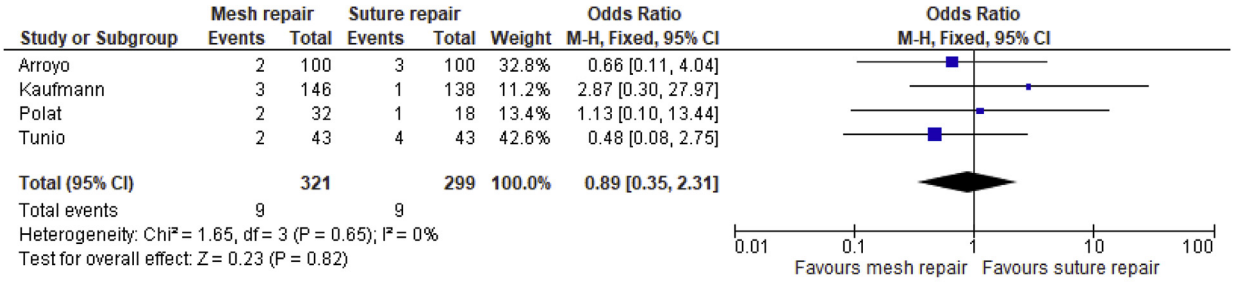

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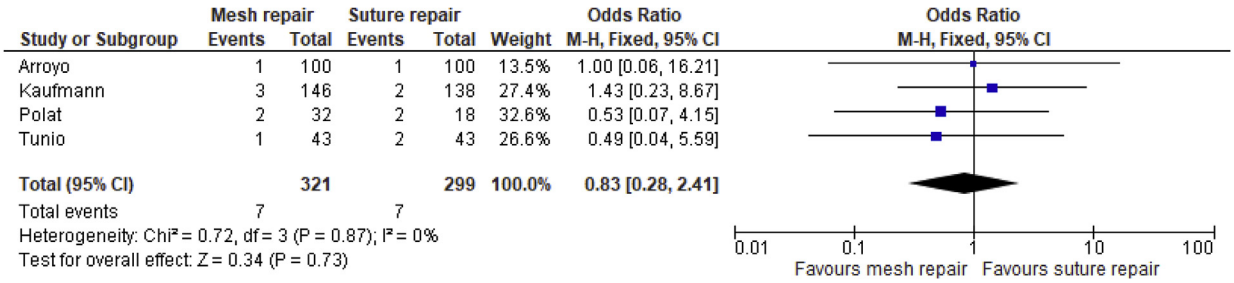

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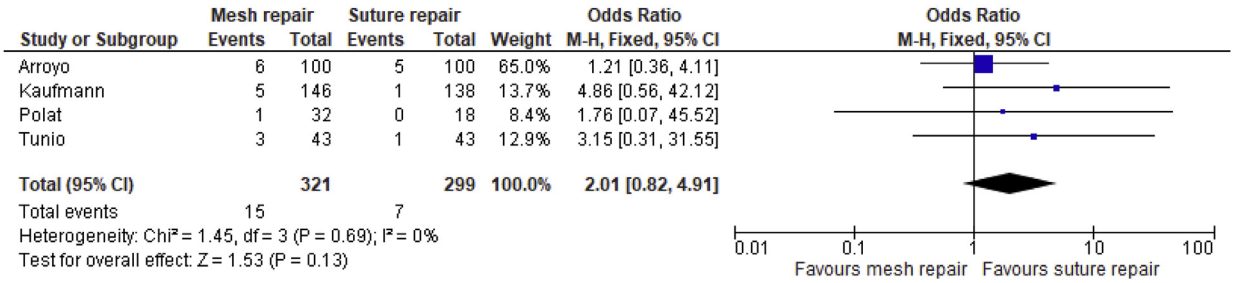

Fig. 2. Forest plots comparing the occurrence of events ((A) recurrence, (B) wound infection, (C) haematoma, and (D) seroma), odds ratios and statistical differences between open mesh and suture repair of umbilical hernia.

infection, haematoma and seroma formation and therefore, open mesh repair should be the preferred method of umbilical hernia repair.

Ethical approval

Not applicable.

Author contribution

Donna Shrestha: data collections, data analysis, writing.
Alice Shrestha: data collections, data analysis, writing.
Badri Shrestha: Study design, data collections, data analysis, writing.

Conflicts of interest

None.

Trial registry number

Review Registry Unique Identifying Number reviewregistry629.

Guarantor

Badri Shrestha.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2018.12.015.

References

[1] F.E. Muysoms, M. Miserez, F. Berrevoet, et al., Classification of primary and incisional abdominal wall hernias, Hernia 13 (4) (2009) 407–414.
[2] R. Kaufmann, J.A. Halm, H.H. Eker, et al., Mesh versus suture repair of umbilical hernia in adults: a randomised, double-blind, controlled, multicentre trial, Lancet 391 (10123) (2018) 860–869.
[3] M.W. Christoffersen, F. Helgstrand, J. Rosenberg, H. Kehlet, P. Strandfelt, T. Bisgaard, Long-term recurrence and chronic pain after repair for small umbilical or epigastric hernias: a regional cohort study, Am. J. Surg. 209 (4) (2015) 725–732.
[4] J.W. Burger, R.W. Luijendijk, W.C. Hop, J.A. Halm, E.G. Verdaasdonk, J. Jeekel, Long-term follow-up of a randomized controlled trial of suture versus mesh repair of incisional hernia, Ann. Surg. 240 (4) (2004) 578–583 discussion 83-5.
[5] R.N. van Veen, A.R. Wijsmuller, W.W. Vrijland, W.C. Hop, J.F. Lange, J. Jeekel, Long-term follow-up of a randomized clinical trial of non-mesh versus mesh repair of primary inguinal hernia, Br. J. Surg. 94 (4) (2007) 506–510.
[6] D.A. Shankar, K.M.F. Itani, W.J. O'Brien, V.M. Sanchez, Factors associated with long-term outcomes of umbilical hernia repair, JAMA Surg 152 (5) (2017) 461–466.
[7] A. Winsnes, M.M. Haapamaki, U. Gunnarsson, K. Strigard, Surgical outcome of mesh and suture repair in primary umbilical hernia: postoperative complications and recurrence, Hernia 20 (4) (2016) 509–516.
[8] N. Aslani, C.J. Brown, Does mesh offer an advantage over tissue in the open repair of umbilical hernias? A systematic review and meta-analysis, Hernia 14 (5) (2010) 455–462.
[9] M.T. Nguyen, R.L. Berger, S.C. Hicks, et al., Comparison of outcomes of synthetic mesh vs suture repair of elective primary ventral herniorrhaphy: a systematic review and meta-analysis, JAMA Surg 149 (5) (2014) 415–421.
[10] A. Arroyo, P. Garcia, F. Perez, J. Andreu, F. Candela, R. Calpena, Randomized clinical trial comparing suture and mesh repair of umbilical hernia in adults, Br. J. Surg. 88 (10) (2001) 1321–1323.
[11] C. Polat, A. Dervisoglu, G. Senyurek, M. Bilgin, K. Erzurumlu, K. Ozkan, Umbilical hernia repair with the prolene hernia system, Am. J. Surg. 190 (1) (2005) 61–64.
[12] N.A. Abdel-Baki, S.S. Bessa, A.H. Abdel-Razek, Comparison of prosthetic mesh repair and tissue repair in the emergency management of incarcerated para-umbilical hernia: a prospective randomized study, Hernia 11 (2) (2007) 163–167.
[13] N.A. Tunio, Hernioplasty: tension free mesh repair versus Mayos repair for umbilical hernias, J. Pakistan Med. Assoc. 67 (1) (2017) 24–26.
[14] Oxford Centre for Evidence-based Medicine – Levels of Evidence, Centre for Evidence-Based Medicine, University of Oxford, March 2009, http://wwwcebmnet/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/2009 , Accessed date: 20 October 2018.
[15] J.P. Higgins, D.G. Altman, P.C. Gotzsche, et al., The Cochrane Collaboration's tool for assessing risk of bias in randomised trials, BMJ 343 (2011) d5928.
[16] AMSTAR (Assessing the methodological quality of systematic reviews) Guidelines. http://wwwamstarca/docs/AMSTAR-2pdf. Accessed 20 October 2018.
[17] Considerations and Recommendations for Figures in Cochrane Reviews: Graphs of Statistical Data, (2008) http://trainingcochraneorg/handbook/graph-recommendations , Accessed date: 20 October 2018.
[18] The GRADEpro Guideline Development Tool (GDT) is the software used to create Summary of Findings (SoF) tables in Cochrane systematic reviews. http://communitycochraneorg/tools/review-production-tools/gradepro-gdt. Accessed 20 October 2018.
[19] R. Gonzalez, E. Mason, T. Duncan, R. Wilson, B.J. Ramshaw, Laparoscopic versus open umbilical hernia repair, J. Soc. Laparoendosc. Surg. 7 (4) (2003) 323–328.
[20] S. Hajibandeh, S. Hajibandeh, A. Sreh, A. Khan, D. Subar, L. Jones, Laparoscopic versus open umbilical or paraumbilical hernia repair: a systematic review and meta-analysis, Hernia 21 (6) (2017) 905–916.
[21] M. Asolati, S. Huerta, G. Sarosi, R. Harmon, C. Bell, T. Anthony, Predictors of recurrence in veteran patients with umbilical hernia: single center experience, Am. J. Surg. 192 (5) (2006) 627–630.
[22] R.L. Berger, L.T. Li, S.C. Hicks, M.K. Liang, Suture versus preperitoneal polypropylene mesh for elective umbilical hernia repairs, J. Surg. Res. 192 (2) (2014) 426–431.
[23] D.M.G. Bowley, A. Kingsnorth, Umbilical hernia, Mayo or mesh? Hernia 4 (2000) 195–196.
[24] J. Dalenback, C. Andersson, D. Ribokas, G. Rimback, Long-term follow-up after elective adult umbilical hernia repair: low recurrence rates also after non-mesh repairs, Hernia 17 (4) (2013) 493–497.
[25] R. Eryilmaz, M. Sahin, M.H. Tekelioglu, Which repair in umbilical hernia of adults: primary or mesh? Int. Surg. 91 (5) (2006) 258–261.
[26] B. Farrow, S. Awad, D.H. Berger, et al., More than 150 consecutive open umbilical hernia repairs in a major Veterans Administration Medical Center, Am. J. Surg. 196 (5) (2008) 647–651.
[27] J.A. Halm, J. Heisterkamp, H.F. Veen, W.F. Weidema, Long-term follow-up after umbilical hernia repair: are there risk factors for recurrence after simple and mesh repair, Hernia 9 (4) (2005) 334–337.
[28] L. Venclauskas, M. Jokubauskas, J. Zilinskas, K. Zviniene, M. Kiudelis, Long-term follow-up results of umbilical hernia repair, Wideochir Inne Tech Maloinwazyjne 12 (4) (2017) 350–356.
[29] B.E. Wright, J. Beckerman, M. Cohen, J.K. Cumming, J.L. Rodriguez, Is laparoscopic umbilical hernia repair with mesh a reasonable alternative to conventional repair? Am. J. Surg. 184 (6) (2002) 505–508 discussion 8-9.