Systematic review of absorbable vs non-absorbable sutures used for the closure of surgical incisions

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Abstract

AIM: To report a systematic review of published randomized controlled trials (RCTs) investigating the role of absorbable suture (AS) against non-AS (NAS) used for the closure of surgical incisions.

METHODS: RCTs investigating the use of AS vs NAS for the closure of surgical incisions were statistically analysed based upon the principles of meta-analysis and the summated outcomes were represented as OR.

RESULTS: The systematic search of medical literature yielded 10 RCTs on 1354 patients. Prevalence of wound infection (OR = 0.97; 95%CI: 0.56, 1.69; Z = 0.11; P = 0.92) and operative morbidity (P = 0.45) was comparable in both groups. Nonetheless, the use of AS lead to lower risk of wound break-down (OR = 0.12; 95%CI: 0.04, 0.39; Z = 3.52, P < 0.0004).

CONCLUSION: This meta-analysis of 10 RCTs demonstrates that the use of AS is similar to NAS for skin closure for surgical site infection and other operative morbidities. AS do not increase the risk of skin wound dehiscence, rather lead to a reduced risk of wound dehiscence compared to NAS.

Key words: Skin closure; Surgical site infection; Wound dehiscence; Absorbable sutures; Non-absorbable suture

Core tip: Based upon the meta-analysis of 10 controlled trials, the absorbable sutures (AS) are similar to non-AS (NAS) for skin closure in cases of wound infection and other complications. AS do not increase the risk of skin wound dehiscence, rather leads to a reduced risk of wound break-down compared to NAS.

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INTRODUCTION

A number of studies have been reported in search of improving the skin closure related outcome measures following various surgical procedures, and due to this fact the skin closure techniques are evolving vastly and immensely, predominantly over the last few decades. Innumerable skin closure methods reported in medical literature include continuous stitch closure, interrupted stitch closure, full thickness closure, sub-cuticular closure, primary closure, secondary closure, vacuum assisted closure, glue assisted closure, skin clips or staples closure, simple suture vs mattress sutures, steri-strips closure, absorbable or non-absorbable suture (NAS) closure and other innovative methods[1-13]. These manifold practices of skin approximation after surgical procedures can
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jointly be classified into two groups. Group I includes the use of NAS for skin closure requiring additional clinical care due to the need of removal of stitches or metallic staples. Group II includes the use of absorbable stitches (AS) or glue which does not require additional clinical care like the group I. The proponents of the use of NAS for skin closure claim that an increased tensile strength of NAS keep wound margins adequately coapted resulting in optimal wound and skin healing[14-16]. The supporters of AS advocate similar effectiveness in wound healing without the requirement of additional clinical care in addition to the benefits of an improved cosmetic outcome and the reduced risk of surgical site infection[17-20]. Due to significant differences in the opinion, the general consensus about the use of either absorbable AS or NAS is still lacking.

The aim of this study is to report a systematic review of published randomized controlled trials (RCTs) on the use of AS against NAS for skin closure.

MATERIALS AND METHODS

Literature search pattern

Relevant published trials for this study were retrieved from the search of MEDLINE, EMBASE, and Cochrane library for controlled trials (RCTs). The MeSH search words such as “absorbable sutures” and “non-absorbable sutures” were put in medical search engines to find studies suitable for inclusion in this systematic review. There was no linguistic, sex, trial size or country of study barrier in our search or inclusion criteria. Boolean operators (AND, OR, NOT) were entered repeatedly at different levels of literature search to achieve maximum number of studies. The published designations of the relevant articles were analysed and checked about their possibility of inclusion in this study. Furthermore, the bibliography of the potentially included studies was scrutinized to find additional studies.

Study selection

The inclusion criteria for this study was agreed which included the RCTs comparing AS and NAS, using any type of AS and NAS, investigating surgical site infection as primary end point without any limitations of age, sex on recruited patients.

Data extraction

After trial selection according to the principles of inclusion criteria, two review authors extracted the trial data from included studies. In case conflict about data, the mutual agreement was achieved by lengthy discussions among all authors. We did not use any statistical tool to calculate the inter-observer matching pattern of the data.

Statistics of the study

The statistics calculations were performed on RevMan 5.3[22,23], delivered by the Cochrane Collaboration. The OR with a 95%CI was calculated to express the combined outcome of the dichotomous variables. The random or fixed effects model using Mantel-Haenszel method (where applicable)[24-25] were used to compute the combined results. The $\chi^2$ test and the $I^2$ were used for detection and quantification of heterogeneity[26-28]. The results were displayed in the form of forest plot. The quality of included RCTs was scrutinised according to the reported recommendations by Jadad et al[29] and Chalmers et al[30]. Based on the quality of the included RCTs, the strength and sum of GRADE quality of evidence was achieved using GradePro[31], an analytical package offered by the Cochrane Collaboration. The surgical site infection was analysed as primary outcome whereas post-operative complications and wound dehiscence was reported as secondary outcomes.

RESULTS

The PRISMA diagram flow chart explaining the trial selection approach, filtration of trials and eventual study inclusion for quantitative and qualitative analysis is shown in Figure 1. Ten RCTs[31-41] on 1354 patients were found suitable for inclusion and for final analysis. Six hundred and sixty-three were investigated in the AS arm and 691 in NAS arm of the included RCTs. Table 1 depicts the characteristics of the included RCTs. Table 2 is showing the various procedures, type of sutures, type of stitches...
used in included RCTs.

**Methodological quality of included studies**

Inadequate randomization approach, improper concealment in the process of allocation, absence of power calculations, lack of utilization of single or double blinding and lastly lack of reporting of IIT were major factors responsible for scoring the majority of included RTCs of poor quality (Table 3). GRADE quality of evidence is shown in Figure 2.

**Surgical site infection**

There was no heterogeneity \(\tau^2 = 0.23, \chi^2 = 12.12, \gamma = 8, (P = 0.15); I^2 = 34\%\) among RCTs that contributed to the combined calculation of this variable. In the random effects model (OR = 0.97; 95\%CI: 0.56, 1.69; \(Z = 0.11; P = 0.92\); Figure 3), the risk of surgical site infection was statistically similar in both groups. Although the AS lead to lower incidence of wound infection but it failed to reach at statistical significance.

**Postoperative complications**

Combined analysis showed significant statistical heterogeneity \(\tau^2 = 0.61, \chi^2 = 20.57, \gamma = 9, (P = 0.01); I^2 = 56\%\) among included RCTs. Therefore, in the random effects model (OR = 0.77; 95\%CI: 0.39, 1.52;
Table 3  Quality assessment of included trials

| Ref.     | Randomisation technique | Power calculations | Blinding | Intention-to-treat analysis | Concealment |
|----------|-------------------------|--------------------|----------|-----------------------------|-------------|
| Dørflinger et al [32] | Consecutive patients | No | Yes | No | Inadequate |
| Foster et al [33] | Consecutive patients | No | No | No | Inadequate |
| Glough et al [34] | Consecutive patients | No | No | No | Inadequate |
| Harimoto et al [35] | Sealed envelop | Yes | No | No | Adequate |
| Kotaluoto et al [36] | Consecutive patients | Yes | No | Yes | Inadequate |
| Lundblad et al [37] | Consecutive patients | No | No | No | Inadequate |
| Pausinho et al [38] | Consecutive patients | No | No | No | Inadequate |
| Szabó et al [39] | No | No | No | No | Inadequate |
| Tan et al [40] | Consecutive patients | Yes | No | Yes | Inadequate |

Figure 2  Strength and summary of the evidence analysed on GradePro®.

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Figure 3  Forest plot for surgical site infection following the use of absorbable suture and non-absorbable suture for skin closure. Odds ratios are shown with 95% CI. AS: Absorbable stitch; NAS: Non-absorbable stitch.
DISCUSSION

The findings of this review article demonstrate that the use of AS is similar to NAS for skin closure for surgical site infection and other operative morbidities. AS do not increase the risk of skin wound dehiscence, rather lead to a reduced risk of wound dehiscence compared to NAS.

The conclusions of this study are consistent with the previously reported several RCTs\cite{32,34-41} and comparative studies\cite{33,36}. Majority of these studies compared the usage of AS against NAS by continuous skin closure stitches. Two trials\cite{33,36} compared the use of AS with NAS by interrupted skin closure stitches. Their outcome was also in favour of AS as for as surgical site infection and postoperative complications are concerned. The comparison between continuous stitch vs interrupted stitch closure of skin by using absorbable or non-absorbable sutures could not be performed in this review due to scarcity of trials and number of patients. Therefore, it is difficult to analyse and conclude the superiority of any technique of skin closure.

Current study has many limitations. There were substantial variances in the inclusion criteria such as RCTs

\[ Z = 0.75; P = 0.45; \text{Figure 4}, \] the incidence of operative morbidity was statistically comparable in both arms of included RCTs. Although the AS was associated with the reduced risk of developing postoperative complications but statistically it was not significant.

**Risk of wound dehiscence**

There was no heterogeneity \[\chi^2 = 3.64, \gamma = 4, (P = 0.46); I^2 = 0\%\] among included RCTs. Six trials\cite{32,36-40} contributed to the combined calculation of this variable. Therefore, in the random effects model (OR = 0.12; 95%CI: 0.04, 0.39; Z = 3.52; P < 0.0004; Figure 5), the use of AS was associated with the reduced risk of developing wound break-down.

**Other variables**

Authors initially planned to analyse other outcome measures such as cosmetic outcomes, stitch granulomas, health-related quality of life measurement, and outcomes comparisons between contaminated and non-contaminated skin wound closures but unfortunately there was either insufficient data reporting or these variables were not investigated.
on general surgical patients, plastic surgical patients and gynaecology were jointly analysed in this review which may be a potential source of bias due to diversity of patients. Further sub-classification of patients in the form of clean and contaminated wounds was not reported and therefore subgroup analysis was not possible to detect the difference in complications and wound infection following the use of AS and NAS. Varying degrees of differences also existed among included RCTs in terms of the definitions of “wound infection” and “wound dehiscence”. RCTs with fewer patients may not have been sufficient power to recognise small differences in primary and secondary outcomes. Different skin closure techniques like interrupted, subcuticular and continuous suturing were reported in included trials. In addition, different types of absorbable sutures were used in the included studies and one may consider this biased. Inadequate randomization approach, improper concealment in the process of allocation, absence of power calculations, lack of utilization of single or double blinding and lastly lack of reporting of IIT were major factors responsible for scoring the majority of included RTCs of poor quality. Variables like foreign body sensation, stitch granulomas, cosmetic score, health-related quality of life measurement and cost effectiveness should have been considered too. Due to significant clinical and methodological diversity among included studies in addition to aforementioned several limitations, a major, multicentre and high quality randomized, controlled trial is required to validate these findings before recommending the routine use of AS for skin closure.

COMMENTS

Background

The conventional way of closing surgical incision wound by non-absorbable interrupted stitches have been largely replaced by the use of absorbable stitches without any conclusive and undisputable evidence in the medical literature. The aim of this article is to find relevant randomized, controlled trials and attempt to generate a guiding evidence to achieve this goal.

Research frontiers

Several study cohorts, comparative studies and randomized trials have been reported comparing absorbable stitches and non-absorbable stitches to close surgical incision wounds with outcomes reported in favour as well as against the use of either suture. Other major concern reported in the published studies was the prevalence of surgical site infection and wound dehiscence. Due to lack of consensus statement on this issue, the evidence based practice is lacking and this article is an attempt to clarify this confusion.

Innovations and breakthroughs

Based upon the meta-analysis of 10 controlled trials, the absorbable sutures are similar to non-absorbable sutures for skin closure in cases of wound infection and other complications. Absorbable sutures do not increase the risk of skin wound dehiscence, rather leads to a reduced risk of wound break-down compared to non-absorbable sutures.

Applications

To the authors’ knowledge this is first systematic review reporting the comparison of both wound closure techniques and highlighting the value of the routine of absorbable stitches for the closure of surgical incision wound.

Terminology

AS: Absorbable stitch; NAS: Non-absorbable stitch; OR: Odds ration; SMD: Standardized mean difference.

Peer review

This is an important paper focusing on systematically analysis of the randomized, controlled trials comparing the use of absorbable vs non-absorbable suture for skin wound closure in surgical patients.

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