Original Article

One vs Two-Layer Closure of the Uterine Wall Following Cesarean Section: Systematic Review Meta-Analysis of Randomized Control Trials

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ABSTRACT

Background: Inappropriate healing of uterine scar after Cesarean section (CS) delivery is associated with adverse OB/GYN evetns. Recently, it was noticed that the incidence of CS increasing all over the world.

Aim of the Work: We aim in our study at comparing two different techniques of uterine closure, one layer versus double-layer using ultrasound and comparing complication rates of CS and other outcomes.

Material and Methods: We searched online databases such as (PubMed, Scopus, and WOS) for linked randomized clinical trials (RCTs). We conducted an online screening of the recalled articles, then related studies were incorporated in our meta-analysis (MA). Two types of data were encountered, the continuous type was expressed as mean difference and 95% confidence interval. On the other hand, dichotomous type of data was expressed as relative risk and 95% CI. Analysis done by Review Manager software (Version 5.4).

Results: In our research, we used 18 RCTs. regarding myometrial thickness after aperation (MD was (1.15) and the 95% CI was (-1.69, -0.60), with the P-value =0.0001). regarding dys-menorrhea (RR was (1.36), and the 95% CI was (1.02, 1.81), with the P-value = 0.04), our results favored two layer uterine closure, however one layer closure had a shorterduration than two layer closure (MD was (-2.25), and the 95% CI was (-3.29, -1). Regarding uterine dehiscence, our results found that (RR was (1.88), and the 95% CI was (0.63, 5.62), with the P-value = 0.26), healing ratio (MD was (-5.00), and the 95% CI was(-12.40, 2.39), with the P-value = 0.18), maternal infection related morbidity (RR was (0.94), and the 95% CI was (0.66, 1.34), with the P-value equal 0.72), and the duration of hospital stay (MD was (-0.12), and the 95% CI (-0.30, 0.06) were comparable outcomes between the two procedures

Conclusion: Two layer closure is superior to one layer closure of cesarean uterine scar in terms of RMT and dysmenorrhea. But one layer closure technique has the advantage over two layer closure in the shorter operation time.

Key Words: Cesarean section, residual myometrium thickness, ultrasonography, uterine cloture.

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INTRODUCTION

Cesarean section (CS) rates have increased during the past few years globally, touching nearly fifty-two% of all deliveries allove the world[1-3]. However, the noted upsurge in this incidence leads to an increased incidence of the complication rate of CS[4]. Short-term complications of CS include infection, thrombosis, and haemorrhage, as well as long-term ones such as dysmenorrhea, dysuria, irregular uterine bleeding, and infertility[4-8]. It was noticed that defective scar in the uterine wall can lead to many complications in the subsequent pregnancu like, placenta increta- percreta, rupture uterus, uterine rupture, and CS scar pregnancy[5,6,9,10].

When pregnant women who have previously undergone caesarean sections go into labour, it is important to assess the risk of uterine rupture. The remaining myometrial thickness and the lower uterine segment ultrasonographic measurement are utilised to evaluate it (RMT)[11,12,13]. PMS, uterine dehiscence, placental adhesion, failure of the labour trial, and other complications of CS scar-pregnancy were all connected to poor RMT and were more likely to occur[6,9,14,15].

RMT, uterine scar defect, and uterine scar healing are all believed to be impacted by the surgical method used for uterus closure after CS. The ideal method for uterine closure hasn't been shown beyond a doubt, though[16,17], and till the moment there is no evidence-based technique for uterine closure is present[18]. Previous research found that two-layer closure resulted in thicker residual myometrium and a lower incidence of severe flaws than double-layer closure. However, there is still insufficient evidence about

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other clinical outcomes[19,20]. This SR and MA compares the ultrasonographic outcomes and complication rates of one layer and two layer uterine closure methods used after CS.

MATERIAL AND METHODS

The preferred reporting items for SR and MA (PRISMA) and the Cochrane handbook for SRs of treatments were used to conduct this SR and MA [21,22].

Data collection process and search strategy

In the databases PubMed, Scopus, Web of Science, and Cochrane, we searched for published RCTs between their start and June 2021. We used the terms surgical technique, endometrium, suture technique, two-layer, double-layer, caesarean section, and postcesarean. Age, publication date, the number of past births, and the indication of a caesarean section were all uncontrolled.

Inclusion VS exclusion criteria

We included RCTs that disclosed any negative events or ultrasonographic results and contrasted one layer uterine closure techniques with two layers following caesarean delivery. Exclusion criteria included editorials, abstracts, theses, letters, books, and chapter summaries as well as non-randomized trials and cross-sectional studies.

Screening process and study selection

Duplicates were eliminated after importing the obtained records into Endnote programme. Following full-text screening in accordance with our eligibility criteria, the remaining records were first subjected to title and abstract screening. The screening procedure was carried out independently by three reviewers, and any discrepancies were resolved through discussion. The meta-analysis comprised articles that met the criteria.

Data extraction

All study authors worked together to extract data. We obtained information on the following domains: 1) a summary of the included studies, including the title of the study, its NCT registration number, the country in which it was conducted, the sample size, the length of the follow-up period, and the findings; 2) the population's baseline characteristics, such as the study arms, participant's age, preterm delivery, multiple pregnancies, elective caesarean delivery, and previous caesarean delivery

Quality assessment

We assessed the quality of the included papers using the Cochrane Collaboration technique for risk of bias assessment in randomised trials[23]. The instrument assessed bias in various areas, including reporting, attrition, detection, performance, and selection. Each domain received one of three risk of bias ratings: low, high, or unknown. Each domain had at least two independent reviewers, and disagreements were resolved through discussion.

Statistical analysis

RevMan software version 5.4 was used for data analysis. Using the inverse-variance approach, data for continuous outcomes were represented as mean difference (MD) and 95% confidence interval (CI), whilst data for dichotomous outcomes were reported as relative risk (RR) and 95% CI. We used the chi-square and I-square tests to examine heterogeneity; heterogeneity was judged significant at a chi-square *P-value* of 0.1 and an I2 more than 50%. For analysis, we employed the random-effects model. We employ subgroup analysis and sensitivity analysis with the leave-two-out test to try to remove heterogeneity in pooled data. Subgroup analyses were performed based on suturing technique, whether locked or unlocked sutures were used, and if the decidua was included in the suture. Because two of the study's findings were reported by 10 or more papers, we were unable to assess publication bias[24,25].

RESULTS

Literature search and study selection

Electronic database searches turned up 3926 items in total. We have 3018 unique articles left after eliminating duplicates, and these were screened for title and abstract. 2907 of these articles were eliminated, and one hundred and eleven of full articles were found and evaluated in accordance with our qualifying standards. Finally, the meta-analysis was only allowed to include 18 papers[5,18,26-41]. (Figure 1) showing the prisma flow chart of our study.

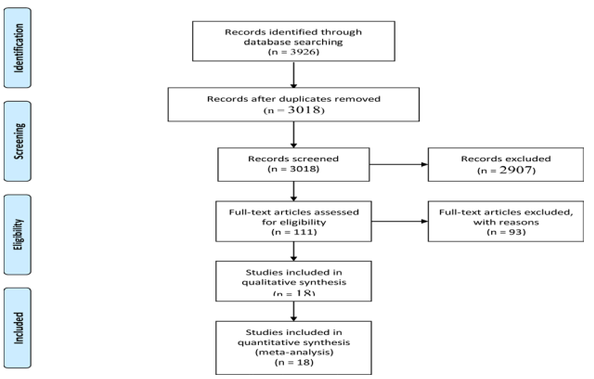


Fig. 1: PRISMA flow chart summarizing the process of data collection and study selection

Features of the included trials

The studies that were included were done in a number of different countries. The sample size varied greatly between investigations, from 30 to 7411. The follow-up period ranged from six weeks in some research to between six and 24 months in others. The average gestational age was between 37.8 and 40 weeks, while the mean age of the patient groups included ranged from 24 to 32 years. (Tables 1,2) indicate, respectively, the summary of the included studies and the baseline characteristics of the included patients.

Quality assessment

As regard selection bias, random sequence generation, and allocation concealment, the majority of included trials exhibited a low risk of bias. Other remaining studies, however, posed a questionable risk of selection bias due to the incompleteness of the given data. Due to the lack of information provided in the majority of research to assess the level of participant and staff blinding, there was uncertainty regarding the likelihood of performance bias. However, because the outcome assessor was properly blinded in the majority of investigations, the risk of detection bias was low. Most studies had low risk of attrition bias since the lost data wouldn't be enough to skew the conclusions. Because the important results were reported as predicted, reporting bias was deemed to be of low risk in the majority of research. Most research rated the "other bias" area as low risk, while others found it uncertain. The risk of bias graph (Supplementary Figure S1) displays the overall assessment of each risk of bias domain, and the risk of bias summary condenses the assessment of each domain in each study (Supplementary Figure S2).

Table 1: Summary of the included studies

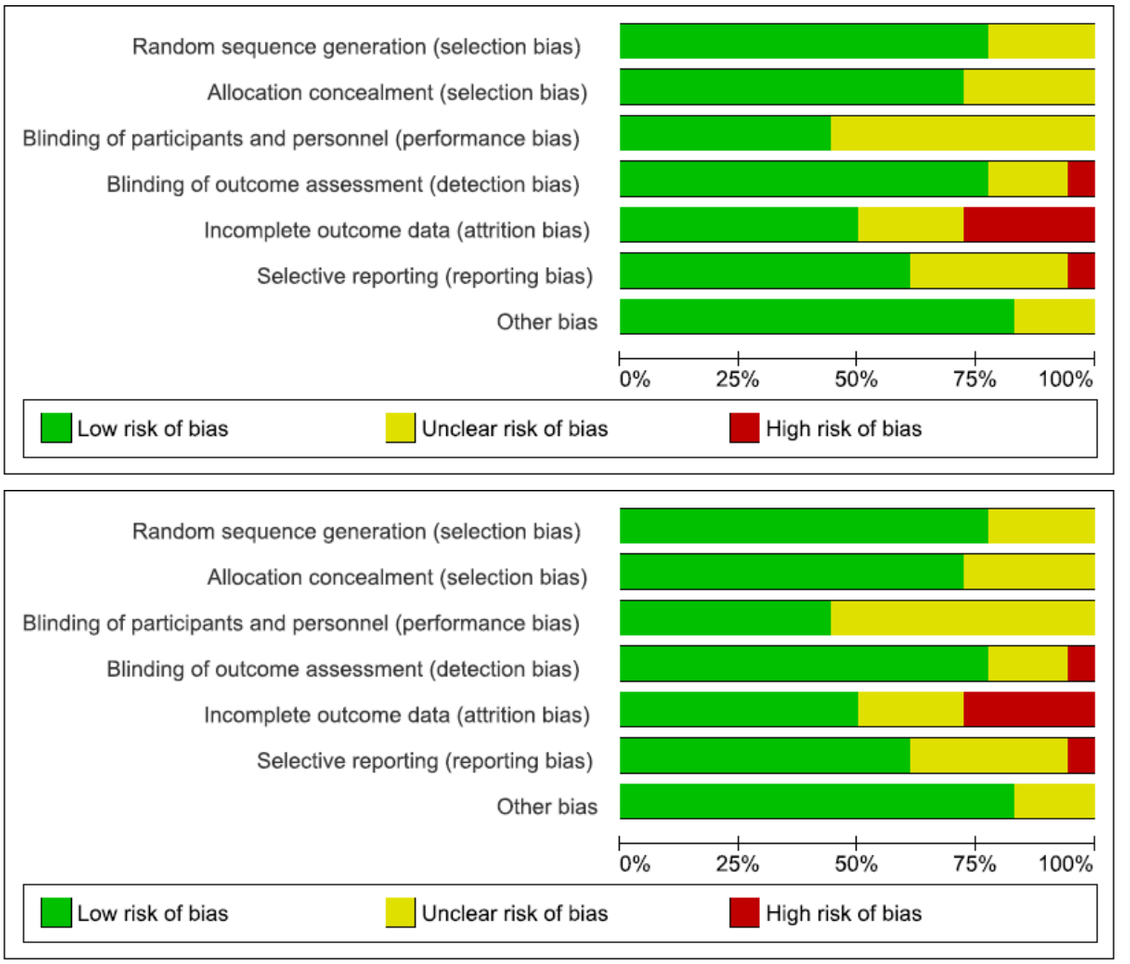
ID	Country	NCT	Sample size	Follow-up	Outcomes
Bamberg 2016	Germany	NCT 02338388	306	6-24 M	Residual myometrium thickness, blood loss, operative time, maternal infectious morbidity
Bennich 2016	Denmark	NCT02144805	76	5 M	Residual myometrium thickness, dysmenorrhea, healing ratio, blood loss, operative time
Caesar 2010	Multicenter	ISRCTN 11849611	2979	6 W	Operative time, maternal infectious morbidity, hospital stay, readmission rate
Chapman 1997	United States	-	145	4 Y	Uterine rupture, hospital stay
Coronis 2016	International	OXTREC; 013-06a	7411	3 Y	Dysmenorrhea, uterine rupture
El-Gharib 2013	Egypt	-	150	6 W	Residual myometrium thickness, operative time, maternal infectious morbidity, hospital stay
Hamar 2007	United States	NCT00224250	30	6 W	Residual myometrium thickness, blood loss, operative time
Hanacek 2019	Czech Republic	-	540	12 M	Residual myometrium thickness, maternal infectious morbidity
Hauth 1992	United States	-	906	-	Maternal infectious morbidity
Kalem 2019	Turkey	-	138	-	Residual myometrium thickness, dysmenorrhea, operative time
Khamees 2018	Egypt	-	80	-	Residual myometrium thickness, blood loss, operative time
Roberge 2016	Canada	NCT01860859	54	6-12 M	Residual myometrium thickness, healing ratio, blood loss, operative time, maternal infectious morbidity
Sevket 2014	Turkey	-	36	6 M	Residual myometrium thickness, healing ratio, blood loss, operative time
Shrestha 2015	Nepal	-	50	6 W	Residual myometrium thickness
Sood 2005	India	-	208	6 W	Blood loss, operative time, maternal infectious morbidity, hospital stay
Stegwee 2020	Netherlands	2015.462	2852	9 M	Residual myometrium thickness, healing ratio, blood loss, operative time, hospital stay, readmission rate
Yasmin 2011	Pakistan	-	60	6 W	Residual myometrium thickness, uterine rupture, blood loss, operative time
Yilmazbaran 2020	Turkey	NCT03629028	282	6-9 M	Residual myometrium thickness, dysmenorrhea, operative time

Abbreviations: W, weeks; M, months; Y, years.

Table 2: Baseline characteristics of the included studies' population

ID	Arms	Number	Age, year	Gestational age at delivery, week	Body mass index, kg/m2	Birthweight, kg	Nulliparity	Preterm delivery	Multiples	Elective cesarean	Prior cesarean deliveries
Bamberg 2016	SL	149	31.8 ± 5.6	37.8 ± 2.2	26.1 ± 5.7	3.15 ± 0.75	63 (42 %)	28 (19 %)	16 (11 %)	117 (78 %)	55 (37%)
	DL	129	30.3 ± 6.5	37.3 ± 2.3	25.6 ± 6.2	3.09 ± 0.67	48 (37 %)	25 (19 %)	13 (10 %)	103 (79 %)	57 (44%)
Bennich 2016	SL	35	30.3 ± 4.5	38.7 ± 0.6	24.6±4.8	-	35 (47.9)	-	-	35 (47.9)	-
	DL	38	30.5 ± 5.5	38.9 ± 0.7	24.1±3.5	-	38 (52.1)	-	-	38 (52.1)	-
Caesar 2010	SL	1483	30.6 ± 5.9	39.0 ± 2.0	-	-	989 (67)	-	79	-	-
	DL	1496	30.6 ± 5.9	39.1 ± 1.9	-	-	480 (32)	-	76	-	-
Chapman 1997	SL	70	-	37 ± 5.2	-	-	-	14	-	-	-
	DL	75	-	40 ± 3.7	-	-	-	25	-	-	-
Coronis 2016	SL	4705	-	-	-	-	-	-	-	-	-
	DL	4711	-	-	-	-	-	-	-	-	-
El-Gharib 2013	SL	75	28.84 ± 3.4	39.11 ± 0.7	-	2.86 ± 0.6	75 (100%)	-	-	-	0 (0%)
	DL	75	28.36 ± 3.2	39.16 ± 0.7	-	2.87 ± 0.6	75 (100%)	-	-	-	0 (0%)
Hamar 2007	SL	15	30 ± 7	39.3 ± 0.5	-	3.35 ± 0.75	11 (73%)	-	-	-	-
	DL	15	25 ± 7	38.6 ± 0.9	-	3.44 ± 0.43	8 (53%)	-	-	-	-
Hanacek 2019	SL	149	31 (29-34)	40 (39-41)	22.4 (20.4-25.3)	-	-	-		-	-
	DL	175	32 (29-34)	40 (40-41)	22.3 (20.1-24.2)	-	-	-		-	-
Hauth 1992	SL	457	24.2	38	-	-	220 (48%)	-	16 (6%)	-	126 (28%)
	DL	449	24.6	37.8	-	-	239 (53%)	-	20 (4%)	-	99 (22%)

Kalem 2019	SL	68	29.25 ± 6.27	38.5 ± 2.7	26.04 ± 2.37	3.23 ± 0.51	-	-	-	-	-
	DL	70	28.94 ± 5. 17	39.4 ± 3.6	25.90 ± 2.28	3.26 ± 0.49	-	-	-	-	-
Khamees 2018	SL	40	-	-	-	-	40 (100%)	-	-	-	0 (0%)
	DL	40	-	-	-	-	40 (100%)	-	-	-	0 (0%)
Roberge 2016	SL	27	30.8 ± 4.0	39.2 ± 0.6	25.1 ± 4.7	3.35 ± 0.379	22	-	-	-	-
	DL with locked sutures	27	31.1 ± 6.4	39.1 ± 0.5	23.5 ± 3.9	3.41 ± 0.44	20	-	-	-	-
	DL with unlocked sutures	27	31 ± 3.7	38.9 ± 0.6	25.1 ± 5.3	3.24 ± 0.47	20	-	-	-	-
Sevket 2014	SL	15	29.7 ± 6.5	38.6 ± 0.8	-	3.44 ± 0.43		-	-	-	-
	DL	16	29.4 ± 7.3	39 ± 1.2	-	3.39 ± 0.38		-	-	-	-
Shreṡtha 2015	SL	25	26.04 ± 5.06	38.36 ± 2.21	-	-	21 (84%)	-	-	16 (64%)	-
	DL	25	23.92 ± 4.32	38.92 ± 1.35	-	-	17 (68%)	-	-	8 (32%)	-
Sood 2005	SL	102	26.5 ± 4.5	38.2 ± 1.5	-	-	-	-	-	66 (64.7%)	34 (33.4%)
	DL	106	25.4 ± 3.5	37.8 ± 1.8	-	-	-	-	-	75 (70.7%)	37 (35%)
Stegwee 2020	SL	1144	32 ± 4.7	-	26.4 ± 4.6	-	-	-	80 (7%)	-	-
	DL	1148	32.1 ± 4.6	-	26.6 ± 4.8	-	-	-	91 (7.9%)	-	-
Yasmin 2011	SL	30	20-35*	37-40*	-	-	-	-	-	-	30 (100%)
	DL	30	20-35*	37-40*	-	-	-	-	-	-	30 (100%)
Yilmazbaran 2020	SL	109	29.8 ± 4.1	38 ± 2	28.9 ± 4.2	3.19 ± 0.57	103 (94.5)	-	-	79 (72%)	-
		116	30.8 ± 5.1	38.1 ± 2.1	29.8 ± 4.6	3.26 ± 0.63	105 (91.3)	-	-	81 (69.3%)	-



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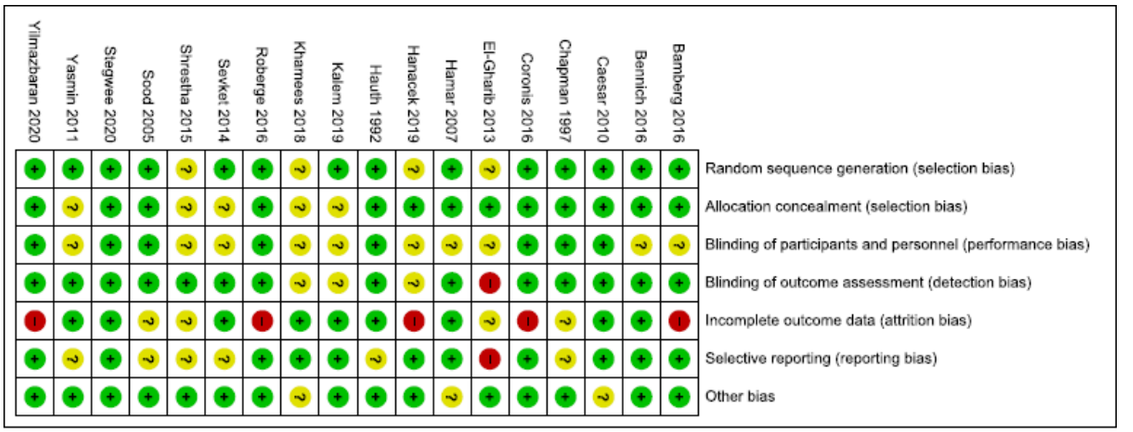

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Outcomes

Residual myometrial thickness

The results were significant and favoured one layer lower uterine segment closure over two layer closure, with a *P-value* of 0.0001 for residual myometrial thickness (MD was (-1.15) and 95% CI was (-1.69, -0.60). In the subgroup with sutures of the locked manner without data on the inclusion of the decidual layer, pooled results were also less favourable with one layer than two layer uterine closure (MD was (-2.51), 95% CI was (-3.28, -1.75), and *P-value* 0.00001). Additionally, one layer demonstrated poorer RMT than two layer uterine closure in the subset of unlocked sutures that included the decidua (MD was (-0.64) and the 95% CI was (-1.14, -0.13), with the *P-value* = 0.01). Both results were homogeneous, with *P values* of 0.36 and I2 values of 0% and 14%, respectively. Furthermore, when one layer closure with locked sutures was compared to two layer closure with unlocked sutures, there was no noticeable difference between the two groups (MD was (-2.24) and 95% CI was (-4.52, 0.04) with *P-value* = 0.05), and the results were heterogeneous with (P equal (0.00001) and the I2 equal 96%).

Blood loss

The amount of blood lost during one layer and two layer uterine closure was identical (MD equal (7.14) and the 95% CI was (-16.21) with the *P-value* equal 0.55), according to our data. The following results were very variable (P equal 0.009 and the I2 equal 61%). Furthermore, when analysising the subgroup we found that cases with sutures locked in parallel to the decidua preferred two layers of uterine closure over one layer (MD equal (36.04) and the 95% CI equal (13.05, 59.03) with the *P-value* of 0.002). The subgroup that includes unlocked sutures and the decidual layer exhibited insignificant results (MD = 1(2.12), 95% CI = (-35.70, 59.93), P = 0.62). Additionally, our results showed no evidence of a diversity between one layer and two layer closure methods (*P-value* = 0.07, MD = (-17.43), 95% CI = (-36,07, 1.21). the following results were homogeneous: P = 0.49; I2 = 0%; P = 0.90; I2 = 0%; and P = 0.27; I2 = 19%.

Operative time

According to pooled data, one layer uterine closure takes less time to complete than two layer uterine closure (MD was (-2.25) 95% CI [-3.29, -1.21], with the *P-value* 0.00001). The pooled data had a high degree of heterogeneity (P equal 0.00001; and I2 equal 78%). The same results were noticed in the locked suture subgroup that lacked information on the decidua (MD equal (-3.78), and the 95% CI was (-5.83, -1.74), with the *P-value* equal 0.0003, and the MD equal (-5.83, -1.74)) respectively. The difference between one layer and two layer closure in the unlocked suture subgroup that contained the decidua was not statistically significant (MD equal (-1.31), and the 95% CI equal (-2.89, 0.26), with the *P-value* equal 0.1).

Maternal infectious morbidity

The incidence of maternal infection morbidity was not significantly different between one layer and two layer uterine closure (RR was 0.94, 95% CI was (0.66, 1.34), *P-value* = 0.72; pooled data). Additionally, the difference in the unlocked sutures groups of which included the decidua, was not statistically significant (RR was 1.13, 95% CI (0.43, 2.96), P = 0.8).

Hospital stay

A combined analysis of the data revealed no discernible difference between one layer and two layer uterine closure in the time spent in the hospital following the procedure (MD was (-0.12), 95% CI was (-0.30, 0.06), and *P-value* was 0.18). The heterogeneity of the pooled results is P = 0.0003 and I2 = 81%. Furthermore, there was no statistically significant difference between the locked suture subgroups without data on including the decidua (MD was (-0.09) and the 95% CI was (-0.34, 0.16) with the *P-value* of 0.5) (the data was homogeneous as following, P equal 0.54; and I2 equal 0%) and the unlocked suture subgroup without data on including the decidua (MD was (-0.25) and the 95% CI was (-0.34, 0.16) with the P (-0.76, 0.26).

Readmission rate (Figure 2)

Our results found a similarity in readmission rate regarding one layer Vs two layer uterine closure techniques (RR was (0.95), and the 95% CI was(0.64, 1.40), with the *P-value* of 0.78). the results were homogeneous (P was 0.86, and the I2 was 0%).

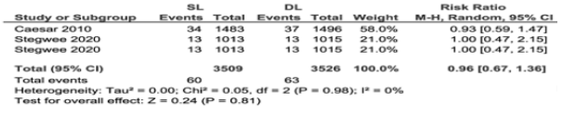

Fig 2: redmission rate

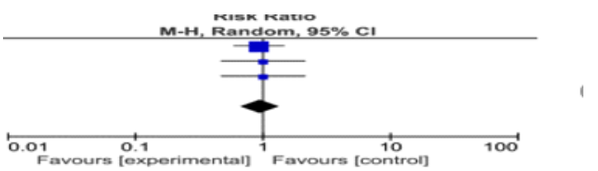

Figure illustration of redmission rate (summary of the included studies)

DISCUSSION

According to the conclusions of a meta-analysis of seventeen randomised controlled trials, two layer uterine closure after caesarean delivery is superior to one layer uterine closure in RMT and dysmenorrhea. In terms of blood loss, healing ratio, length of hospital stay, risk of maternal infection, readmission rate, and possibility of uterine rupture or dehiscence with a later delivery, both methods had comparable results. However, one layer closure yielded superior results in terms of operating time.

As narrated by previous studies[17,20], Thicker RMT was linked to one layer uterine closure compared to two layer closure. In our investigation, the use of locking sutures in both one layer and two layer closure techniques made this conclusion more pronounced. Additionally, a prior meta-analysis found that for RMT, a two-layer closure with unlocked sutures was preferable to a one-layer closure with locked sutures[20].

Our results goes in parallel with[5,20,28] regarding dysmenorrhea associated with one layer closure. Though, a hot trial concluded the same results with both techniques[18]. In our analysis, the recent trial by Yilmaz Baran 2020 was cited as evidence for the effectiveness of the two layer closure approach[41], although other pooled results concluded insignificant outcomes[5,28,35]. By combining the findings of all previously published RCTs, the current study resolves this argument in favour of the two layer closure technique.

Our results support the literature's findings that both one layer and two layer closure operations have comparable risks for uterine dehiscence or rupture in the next pregnancy[16,17,20,42].

Our analysis also covered other on long run effects. Which included, blood volume loss, length of hospital wait following the operation, and the prevalence of maternal infections. Combining these findings revealed no appreciable distinction between a one- and two-layer closure. An earlier meta-analysis produced comparable findings[20].

One layer closure is recognised to be simpler and quicker than two layer closure, as the findings of our study showed[20,41]. Most obstetricians favour a one-layer closure over a two-layer closure in order to save the surgical time without noticeably raising the risk of problems[5,26]. One layer closure is also linked to lower niche prevalence, less gynaecological issues that need to be treated, and less negative effects on sexual activity and general health, according to a recent randomised multi-center study[18].

Although this investigation and earlier studies found that the two layer closure produced improved sonographic results, these results appear to be clinically unimportant[20,18,41].

It is necessary to put standards for uterine closure techniques following CS. This is because there are more than two million caesarean deliveries performed annually in the United States[43,44]. Additionally, this would assist pregnant women who have previously had a caesarean delivery in deciding whether to try labouring naturally or to have an elective repeat caesarean delivery[43,44].

Strengths and limitations

In order to provide high-quality evidence, we only included RCTs in our SR and MA. We also followed the universally acknowledged PRISMA guidelines when carrying out this work. We included all published trials on our analysis, regardless of date of publication. Subgroup analyses was done based on differences in surgical procedures other than one layer and two layer closure in order to address the diversity between studies. Two of the study's shortcomings include the heterogeneity that was observed in many of the outcomes and that in some cases could not be resolved. Additionally, the findings are less generalizable because just a small number of studies included some long-term outcomes.

CONCLUSION

Two layer uterine closure is preferred to one layer caesarean uterine scar closure for RMT and dysmenorrhea. One layer closure has the superiority regarding operating time, though. Both procedures are comparable in terms of bleeding, healing rate, the duration of staing in hospital, readmission rate, infectious rate, and danger of uterine rupture or dehiscence.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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