



Systematic Review / Meta-analysis

Prevalence and associated factors of post dural puncture headache among parturients who underwent cesarean section with spinal anesthesia: A systemic review and meta-analysis, 2021

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ABSTRACT

Introduction: PDPH is a headache that develops after dural puncture which worsens in an upright position, and improves with lying down. It could affect maternal satisfaction and health care quality. The prevalence and factors of PDPH vary based on different literature and there is no previous meta-analysis done.

Methods: This study was done by searching studies from databases PubMed/MEDLINE, Google scholar, and google. Data were extracted by three reviewers independently by using Microsoft Excel and then exported to STATA™ 16 version statistical software for analysis. Heterogeneity assessed using the I^2 statistic. With a random model meta-analysis, the pooled prevalence of post-dural puncture headache and its associated factors (POR) with a 95% confidence interval was estimated.

Result: Eight studies with a total of 175, 652 study participants were included to estimate the pooled prevalence of PDPH following cesarean section under spinal anesthesia. The pooled prevalence of PDPH in this meta-analysis was found to be 23.47% with 95% CI (10.53, 36.42). Having normal BMI, multiple attempts of spinal injection and spinal injection with a needle size of less than or equal to 22 gauge were positively associated with the PDPH with AOR and 95% CI of 1.22 (1.09, 1.35), 3.50 (1.55, 5.44) and 7.36 (4.93, 9.80) respectively.

Conclusion: The pooled prevalence of PDPH among parturients who gave birth with the cesarean section under spinal anesthesia is estimated to be 23.47%. Having normal BMI, multiple attempts of spinal injection, and spinal injection with a needle size of less than or equal to 22 gauge were positively associated with the PDPH.

1. Introduction

Spinal anesthesia is widely used for cesarean section currently for its safety, low cost, reliability, easiness to administer, immediate effect, and well-operating conditions [1–3]. This technique is not free from complications. Post-dural puncture headache is one of the most frequent complications of spinal anesthesia [1,4–7].

According to the International Classification of Headache Disorders criteria, PDPH is a headache that develops within 5 days after dural puncture which worsens in an upright position and improves with lying down and accompanied by neck stiffness, tinnitus, photophobia, and nausea. It may disappear spontaneously within 1 week or up to 48 h after an epidural blood patch. Conservative therapies such as bed rest, hydration, and caffeine are commonly used as management [8].

The patterns of development of PDPH depend on a procedure and non-procedure-related risk factors [4,9]. According to literature the

incidence of PDPH after spinal anesthesia ranges from 0.3% to 40% and affected by factors like age, gender, needle size and type, multiple attempts of spinal performance, spinal anesthesia injection at sitting position, and previous PDPH [1,2,5,7,10,11]. On top of these factors, having high levels of estrogens which may influence the tone of the cerebral vessels, thus increasing the vascular distension response to CSF hypotension put pregnant mothers at increased risk for PDPH [5,12].

This phenomenon could affect maternal satisfaction and health care quality. The prevalence and factors of PDPH vary based on different literature and there is no previous meta-analysis done. Therefore, we conducted this systematic review and meta-analysis to have a pooled prevalence and associated factors of PDPH for parturients who gave birth with cesarean sections under spinal anesthesia.

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2. Methods

2.1. Study setting and search strategies

This systematic review and meta-analysis was conducted to estimate the pooled prevalence of PDPH among parturients who gave birth with the cesarean section under spinal anesthesia. Potential studies were identified using databases PubMed/MEDLINE, Hinari, Google scholar, and google search. Additionally, a hand search was applied to identify additional literature by using key terms and via cross-references, links, and citations in google scholar and PubMed. All searches were limited to the English language and studies published within ten years. The search was performed on 28–31/2/2021 from all databases. Medical subject heading (MeSH) terms (“Pregnant Women” OR “Gravidity” OR “Mothers” OR “Obstetrics” OR “Women” OR “Female”) AND (“Anesthesia” OR “Anesthesia, Spinal” OR “Spinal Puncture”) AND (“Headache” OR “Post-Dural Puncture Headache”) search were used. The results were further restricted by free full text and human species. This meta-analysis was registered in research registry with a registration number of reviewregistry1133. This systematic review and meta analysis was reported according to the PRISMA checklist [13].

2.2. Eligibility criteria

We used **CoCoPop** (Condition: Post-dural puncture headache, Context: World-wide, and Population: Parturients who gave birth with the cesarean section under spinal anesthesia) approach to include and exclude studies.

2.2.1. Inclusion criteria

This systematic review and meta-analysis included articles that met the following criteria: All studies conducted on the prevalence and/or factors associated with PDPH among parturients who gave birth with the cesarean section under spinal anesthesia and articles published with the English language which has free full text were included.

2.2.2. Exclusion criteria

Studies that reported neither prevalence nor associated factors of PDPH were excluded. Studies lacking appropriate data and failure to reply from the corresponding authors within two weeks were excluded from this meta-analysis.

2.2.3. Outcome measurement

The main outcome of interest for this meta-analysis was the pooled prevalence of PDPH and associated factors among parturients who gave birth with the cesarean section under spinal anesthesia.

2.2.4. Quality assessment and data extraction

The quality of the studies was critically appraised by the modified Newcastle-Ottawa appraisal assessment tool established for cross-sectional, case-control, and cohort studies [14]. The quality of all the included eight studies was graded as “high quality”.

Authors’ names with a year of publication, study area, study design, sample size, the prevalence of PDPH and factors with AOR were extracted. The titles and abstracts of all identified literature in the searches were reviewed by three authors. Included studies were reviewed by three authors independently, and decisions were made regarding selection/rejection. The disagreements arising were resolved by the discussion of all the authors.

2.2.5. Statistical analysis

The necessary information from each study was extracted by using a Microsoft Excel spreadsheet. The extracted data was imported to STATA™ version 16.0 software for analysis. The pooled prevalence of PDPH and its associated factors were determined by the random-effects model using DerSimonian-Laird weight [23]. The pooled effect size with

a 95% confidence interval was presented using a forest plot.

2.2.6. Heterogeneity and publication bias

The I^2 statistic was used to evaluate the presence or absence of heterogeneity between studies [23]. Subgroup analysis by using study design, sample size, publication year, and study setting was performed to minimize heterogeneity. Sensitivity analysis was conducted to determine the possible included outlier articles. Publication bias was checked by using funnel plot and Egger test [24,25].

3. Results

3.1. Search strategy

In this systemic review and meta-analysis, a total of 4216 articles were identified through different databases search. One thousand one hundred twenty-three (1123) articles were left after removing duplicates. The remaining 1123 articles were screened for their title and abstract based on which 1111 articles were excluded. From the remaining 12 articles, four articles were excluded for reasons. Finally, eight potential articles had been included for qualitative and quantitative synthesis (Fig. 1) [26].

3.2. Characteristics of included studies

In the current systematic review and meta-analysis, a total of 175,812 parturients were included from eight studies with a sample size ranging from 146 [18] to 172,599 [19]. The prevalence of PDPH among the included studies varied from 1.16% [19] to 48.8 [17]. Regarding study design, three studies [15,19,20] employed a cross-sectional design; four cohort studies [16–18,27] and two RCT studies [21,22]. Furthermore, concerning the study population, 7 studies [28–33] were conducted only on parturients [15–18,20,21,27,34] whereas the remaining two were done on all patients from whose we extracted data of cesarean section [19,22] (Table 1).

3.3. Meta-analysis

3.3.1. Publication bias

The possibility of publication bias across the studies was observed by using a funnel plot, Begg’s and Egger’s regression test [25,35]. The funnel plot, Begg’s test, and Egger’s test indicated that there was no publication bias observed between the studies (Begg’s and Egger’s regression tests p-values = 0.3865 and 0.1380 respectively). The symmetry of the funnel plot also indicated that there was no publication bias (Fig. 2). The trim and fill to identify the effect of missed studies on the publication bias showed there is no imputed study identified for publication bias.

3.4. The pooled prevalence of PDPH

Eight studies with a total of 175,652 study participants were included to estimate the pooled prevalence of PDPH following cesarean section under spinal anesthesia. The prevalence of PDPH among included studies varies from 1.16% [19] to 48.8 [17]. The pooled prevalence of PDPH in this meta-analysis was found to be 23.47% with 95% CI (10.53, 36.42). There was a significant heterogeneity across the included studies ($I^2 = 99.57\%$, $P = 0.00$). Therefore, random effect models were used to determine the pooled prevalence of PDPH among study participants (Fig. 3).

3.5. Subgroup analysis

Subgroup analysis was done to minimize the possible source of heterogeneity by study setting (Africa, Asia, Australia, Europe, and America), sample size (less than or equal to 250 and greater than 250),

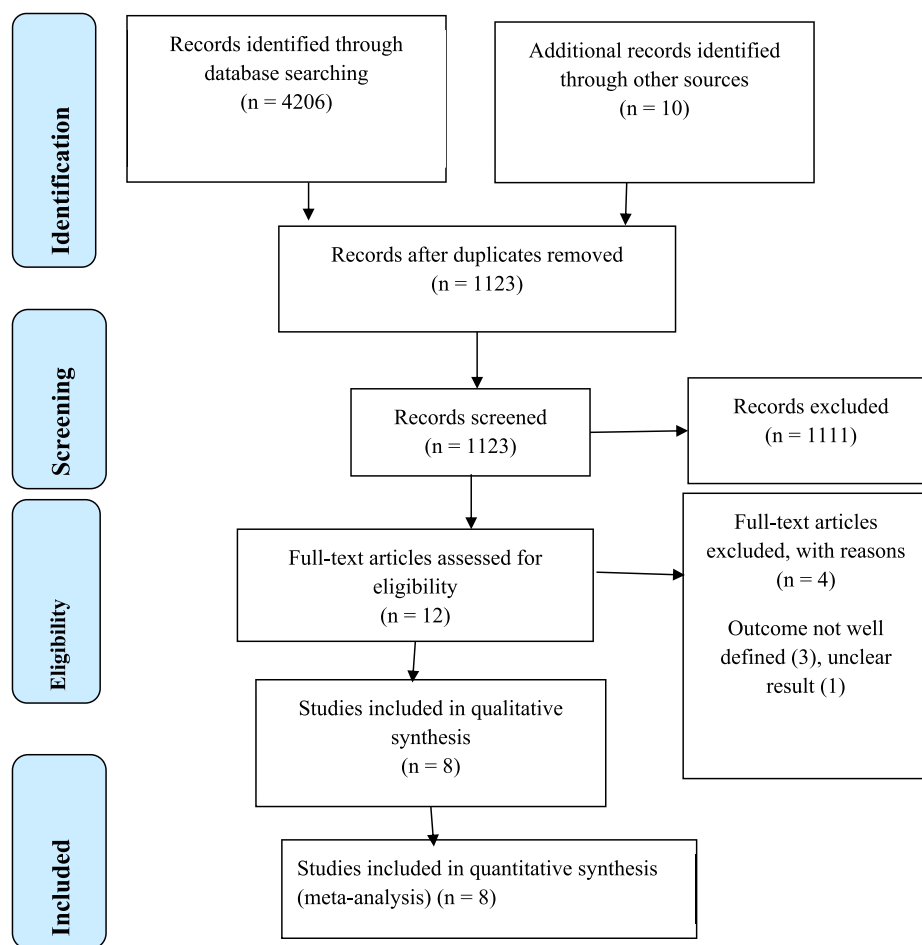


Fig. 1. PRISMA flow diagram showing search strategies.

Table 1

Characteristics of studies included in the systematic review and meta-analysis of PDPH for parturients who gave birth with the cesarean section under spinal anesthesia, 2021.

First author, Publication year	Study area	Study design	Study population	Sample size	Prevalence of PDPH (%)	Follow up duration	Quality status
Tarekegn et al., 2017 [15]	Ethiopia	Cross sectional	Parturients	251	42.6	3 days	high quality
Khraise et al., 2017 [16]	Jordan	Cohort	Parturients	680	6	3 days	high quality
Nambooze et al., 2019 [17]	Mulago	Cohort	Parturients	1294	48.8	7 days	high quality
Ayyuba et al., 2017 [18]	Nigeria	Cohort	Parturients	146	15.8	3 days	high quality
Makito et al., 2020 [19]	Japan	Crosssectional	Parturients	172,599	1.16	-	high quality
Frias Carrazana et al., 2018 [20]	Cuba	Crosssectional	Parturients	288	33.3	5 days	high quality
Uluer et al., 2019 [21]	Turkey	RCT	Parturients	200	30	7 days	high quality
Pirbudak et al., 2019 [22]	Turkey	RCT	Parturients	204	20.8	7 days	high quality

NB: RCT; Randomized Control Trial; PDPH: Post-dural Puncture headache.

study design (cross-sectional, cohort, and RCT) and year of publication (2017/18 and 2019/20). Based on subgroup analysis, the highest and lowest pooled prevalence of PDPH was seen in a study setting. Accordingly, the highest proportion of PDPH was seen in Australia with the prevalence of 48.8 (46.06, 51.52) [17], while the lowest was seen in Asia with the prevalence of 3.49 (-1.25, 8.23) [16,19] (Table 2).

3.6. Sensitivity analysis

A sensitivity test was done using the random effect model and the result depicted that there was no single study that influenced the overall prevalence of PDPH significantly (Fig. 3).

3.7. Meta-regression analysis of the prevalence of PDPH

Investigation of heterogeneity: Meta-regression was done based on a study design, sample size, publication year, and study setting to appreciate the possible cause of differences across included studies. But, it failed to show the significance (Table 3).

4. Factor analysis

In this systematic review and meta-analysis factors like having normal BMI, being overweight, being obese, multiple attempts of spinal injection, spinal injection with a needle size of less than or equal to 22 gauge were the factors identified during data extraction from the eight included studies (see Fig. 4). From these factors having normal BMI, multiple attempts of spinal injection and spinal injection with a needle

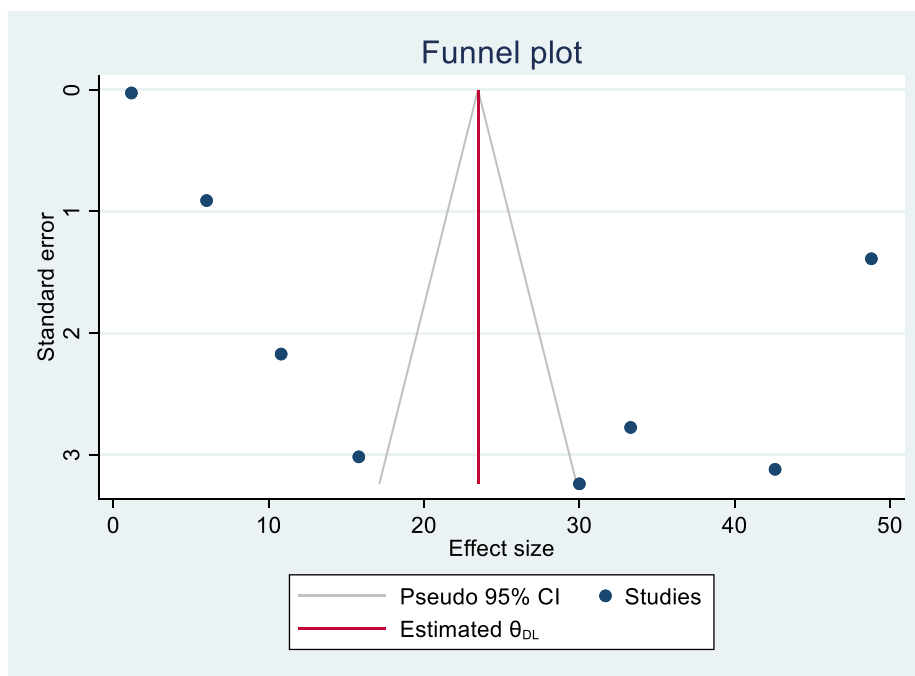


Fig. 2. Funnel plot to test publication bias of included studies.

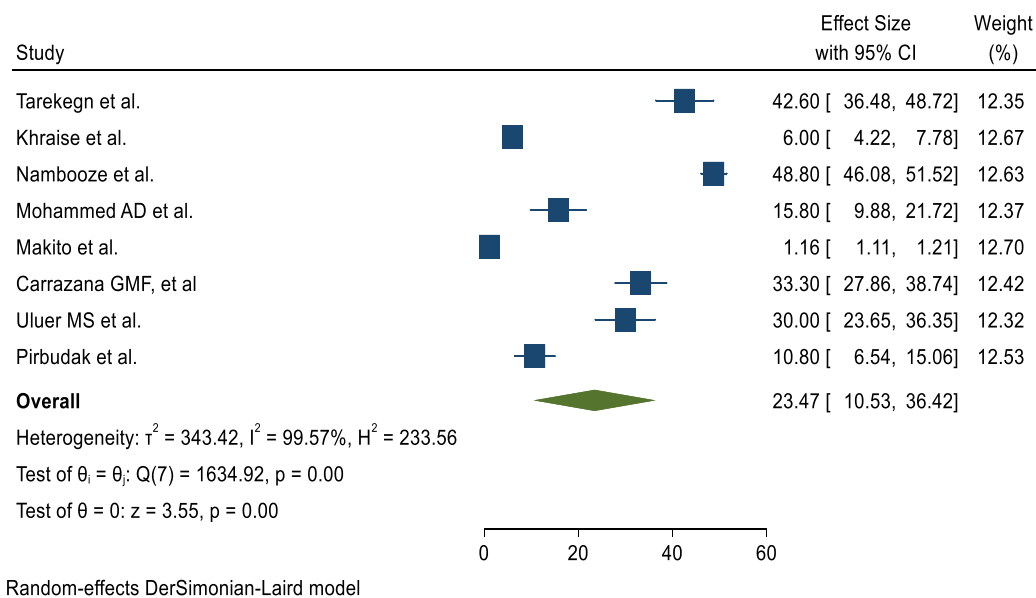


Fig. 3. Forest plot showing the pooled estimate of PDPH following cesarean section under spinal anesthesia.

size of less than or equal to 22 gauge were positively associated to the PDPH with AOR and 95% CI of 1.22 (1.09, 1.35), 3.50 (1.55, 5.44) and 7.36 (4.93, 9.80) respectively (Fig. 5).

5. Discussion

This systemic review and meta-analysis were conducted to estimate the pooled prevalence of PDPH among parturients who gave birth with the cesarean section under spinal anesthesia. The pooled prevalence of PDPH was 23.47% with 95% CI (10.53, 36.42). The pooled prevalence of PDPH in this meta-analysis was higher than studies done in Jordan by Khraise et al., 2017 with a prevalence of 6% [16], Nigeria by Mohammed et al., 2017 with a prevalence of 15.8% [18], Japan by Makito et al.,

2020 with a prevalence of 1.16% [19] and turkey by Pirbudak et al., 2019 with a prevalence of 10.8% [22]. Our result is lower than studies done in Ethiopia by Tarekegn et al., 2017 with a prevalence of 42.6% [15], in Mulago by Nambooze et al., 2019 with a prevalence of 48.8% [17], in Cuba by Carrazana et al., 2018 with a prevalence of 33.3% [20] and in Turkey by Uluer et al., 2019 with a prevalence of 30% [21]. The discrepancy might be due to the variation in sociodemographic characteristics across studies, clinical setup differences, and study design.

From a subgroup analysis done by (study setting, sample size, study design, and year of publication), except in a study setting others to have a nearly similar pooled prevalence of PDPH. Accordingly, the highest proportion of PDPH was seen in Australia with the prevalence of 48.8 (46.06, 51.52) [17], while the lowest was seen in Asia with the

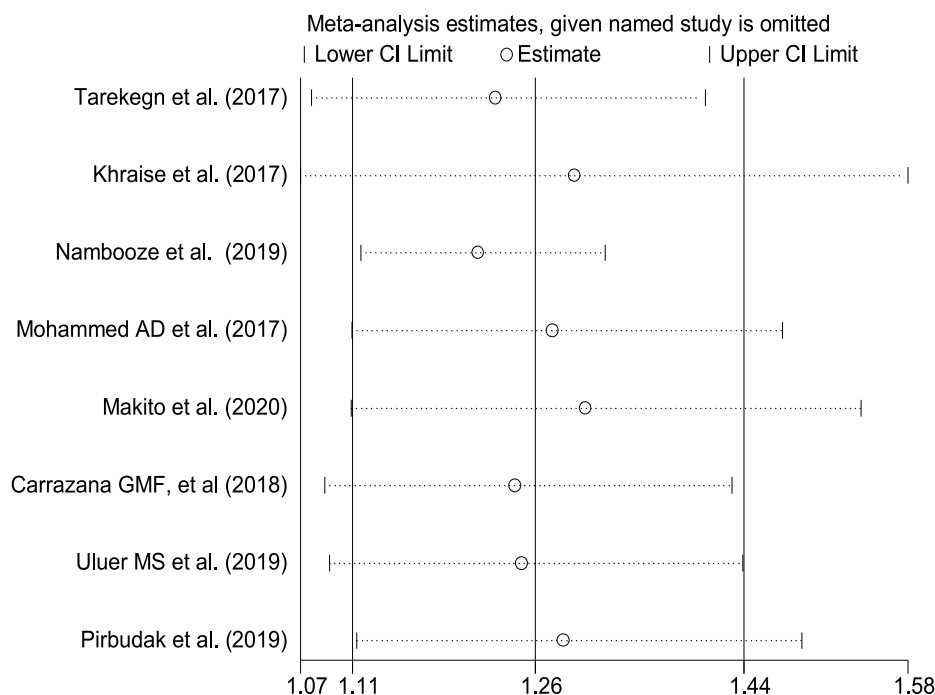


Fig. 4. Sensitivity analysis of on the prevalence of PDPH among parturients who gave birth with cesarean section under spinal anesthesia.

Table 2

The pooled prevalence of PDPH by study setting, sample size, study design, and year of publication.

Variables	Characteristics	Included studies	Sample size	Prevalence (95% CI)
Study setting	Africa	2	397	29.19 (2.92, 55.45)
	Asia	2	173,279	3.49 (-1.25, 8.23)
	Australia	1	1294	48.80 (46.06, 51.52)
	Europe	2	404	20.25 (1.44, 39.06)
	America	1	288	33.30 (27.86, 38.74)
Sample size	≤250	3	550	18.69 (7.70, 29.67)
	>250	5	175,112	26.25 (8.94, 43.56)
Study design	Cross sectional	3	173,138	25.57 (-3.70, 54.85)
	Cohort	3	2120	23.55 (-7.45, 54.55)
	RCT	2	404	20.25 (1.44, 39.06)
Publication year	2017/18	4	1365	24.31 (6.15, 42.48)
	2019/20	4	174,297	22.67 (-4.61, 49.95)
Overall		8	175,662	23.47 (10.53, 36.42)

NB: CI: confidence interval; RCT: Randomized controlled trial.

Table 3

Meta-regression analysis of PDPH following cesarean section under spinal anesthesia.

Heterogeneity source	Coefficients	Std. error	p-value
Study design	-20.95	53.20	0.694
Sample size	26.85	56.04	0.63
Publication year	16.09	53.20	0.76
Study setting	-10.73	28.32	0.71

prevalence of 3.49 (-1.25, 8.23) [19]. This discrepancy might be due to differences in settings and study design.

From the extracted data of this systematic review and meta-analysis, factors like having normal BMI, multiple attempts of spinal injection, and spinal injection with a needle size of less than or equal to 22 gauge were 1.2, 3.5, and 7.36 times riskier to develop PDPH as compared to their comparators.

The effect of normal BMI, multiple attempts, and using needle size less than and equal to 22 gauge was in line with studies done in Japan [19], Ethiopia and Jordan [15,16] and, Cuba [20].

5.1. Limitations and challenges

To do this meta analysis and systematic review, we tried to search literatures. But there were shortage of RCT and we included all types of study design to get large articles. The included articles are done in abroad at the developed and developing regions. These factors leads for heterogeneity of the articles. Subgroup analysis was performed to minimize heterogeneity.

6. Conclusion

The pooled prevalence of PDPH among parturients who gave birth with the cesarean section under spinal anesthesia is estimated to be 23.47%. Having normal BMI, multiple attempts of spinal injection, and spinal injection with a needle size of less than or equal to 22 gauge were positively associated with the PDPH.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Availability of data

All the necessary data are presented in the manuscript and further reasonable requests will be provided by the correspondence.

Abbreviations

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
PDPH	Post-dural Puncture Headache
SA	Spinal Anesthesia

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.102456>.

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