Current Anesthesia Methods for No-Scalpel Vasectomy: A Systematic Review

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Abstract

Introduction: *This study was aimed to described current anesthesia methods to facilitate no-scalpel vasectomy procedure.*

Methods: *A systematic review based on PRISMA guideline was conducted which included all the studies discussing no-scalpel vasectomy and focusing on its anesthesia method. Outcomes searched were pain during anesthesia and procedure. Literature search was done through search engines (PubMed, EBSCO Host and Cochrane library) using (''no-scalpel vasectomy'' OR ''scalpel-free vasectomy'' OR ''vasectomy'') AND (''anesthesia'') as keywords and through manual search. Literature selection process was done by two reviewer and qualified studies were subjected to quality assessment.*

Results: *A total of 446 literatures were found and five studies satisfying the eligibility criteria and discussed following anesthesia methods: local infiltration anesthesia (LIA), spinal cord block (SCB), no-needle anesthesia (NNA), mini-needle anesthesia (MNA) and eutectic mixture of local anesthetic (EMLA). This study showed that the average score of pain (VAS 1-10) during no-scalpel vasectomy procedure for LIA, combination of LIA and SCB, NNA, MNA and combination of LIA and EMLA were 1.86 – 2.7, 0.64, 0.66 – 2.13, 0.66 and 2.15, respectively.*

Conclusion*: Combination of LIA and SCB, NNA and MNA showed promising results as anesthesia methods. However, these promising results should be further proven by more studies.*

Key-words:*, anesthesia, EMLA, local infiltration anesthesia, no-scalpel vasectomy, spermatic cord block*

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Metode Anestesi Terkini untuk Vasektomi Tanpa Pisau Bedah: Sebuah Tinjauan Sistematik

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Abstrak

Pendahuluan: *Studi ini bertujuan untuk menjabarkan metode anestesi terkini dalam menjalankan prosedur vasektomi tanpa pisau.*

Metode*. Studi ini merupakan sebuah tinjauan pustaka sistematis yang mengacu kepada PRISMA guideline dan mencari seluruh kepustakaan mengenai vasektomi tanpa pisau yang berfokus kepada metode anestesi. Luaran yang dicari dari studi ini adalah nyeri saat dilakukan proses anestesi dan prosedur vasektomi tanpa pisau. Penelusuran literature dilakukan melalui mesin pencari (PubMed, EBSCO Host and Cochrane library) dengan menggunakan kata kunci ("no-scalpel vasectomy" OR "scalpel-free vasectomy" OR "vasectomy") AND ("anesthesia") dan melalui pencarian manual. Seleksi kepustakaan dilakukan oleh dua orang dan studi yang memenuhi kriteria akan dinilai secara kualitas.*

Hasil: *Terdapat 446 kepustakaan yang ditemukan, namun hanya terdapat 5 studi yang memenuhi kriteria dengan metode anestesi yang ditemukan sebagai berikut: local infiltration anesthesia (LIA), spinal cord block (SCB), no-needle anesthesia (NNA), mini-needle anesthesia (MNA) and eutectic mixture of local anesthetic (EMLA). Studi ini menemukan rerata nilai nyeri (VAS 1-10) saat dilakukan prosedur vasektomi untuk LIA, kombinasi LIA dan SCB, NNA, MNA serta kombinasi LIA dan EMLA adalah 1.86 – 2.7, 0.64, 0.66 – 2.13, 0.66 dan 2.15.*

Kesimpula*n. Kombinasi LIA dan SCB, NNA serta MNA menunjukkan hasil yang menjanjikan sebagai metode anestesi untuk prosedur vasektomi tanpa pisau. Namun hasil yang menjanjikan ini perlu dibuktikan lebih jauh.*

Kata Kunci: *no-scalpel vasectomy, anesthesia, local infiltration anesthesia, spermatic cord block, EMLA*

Introduction

Vasectomy is a reliable and cost-effective permanent contraception method for male patient with no-scalpel vasectomy as the chosen approach due to its shorter operative time, less pain and lower complication rate.[1–6] Even though it was claimed to produce less pain, some of the patients still hesitate to undergo vasectomy due to fear of pain. Therefore, anesthesia has crucial role in this matter.[7]

Infiltration technique for vasal block is the standard and most widely used anesthetic technique for no-scalpel vasectomy. There were several studies regarding effectivity of other anesthesia methods/techniques used in vasectomy, such as eutectic mixture of local anesthetic (EMLA) and usage of buffered xylocain.[1,8] However, those studies were applied to conventional/standard vasectomy.[9–12] Therefore, this study was aimed to find out current anesthesia methods which specifically facilitate no-scalpel vasectomy procedure.

Methods

Eligibility Criteria

Referring to the purpose of this study, all literatures discussing no-scalpel vasectomy and focusing on its anesthesia method were included. No specific patient's demographic characteristics was determined to be included in this study. Study design could be interventional or observational study with or without comparison group. However, non-systematic review articles, case-report studies or animal studies were

excluded from further literature selection process. The outcomes searched from this study were pain during anesthesia and procedure.

Information Sources and Searching Strategy

Literature searching was done using search engines and manual search through references of relevant studies or abstracts from relevant symposiums. Literature searching using search engines was done through PubMed, EBSCO Host and Cochrane library. This study used ("no-scalpel vasectomy" OR "scalpel-free vasectomy" OR "vasectomy") AND ("anesthesia") as keywords for search engines in March 2018.

Literature Selection Process and Data Extraction

Literatures obtained were collected in EndNote X8 software and were screened for duplication. Free-duplication literatures were screened for its titles and abstracts and the qualified literatures were further screened for its full text paper by two reviewers. Different opinion between two reviewers was settled through discussion.

Following data of the qualified literatures were extracted, if available: author and year of publication, type of literature, type of anesthesia method, description of anesthesia method and technique, number of population and results.

Literature's Quality Assessment

Quality of each qualified literatures were subjected to quality assessment using Cochrane Risk of Bias Assessment Tools for interventional studies[13] and Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies by National Institutes of Health (NIH) for observational studies.[14]

Results

A total of 446 studies were obtained through search engines and manual search. After title, abstract and full text screening, five literatures which satisfied the eligibility criteria were selected (Figure 1). Those literatures were composed of three observational and two interventional studies which discussed the following anesthesia methods: local infiltration anesthesia (LIA), spinal cord block (SCB), no-needle anesthesia (NNA), mini-needle anesthesia (MNA) and eutectic mixture of local anesthetic (EMLA). The summary and studies' quality assessment can be seen in Table 1-3.

Local infiltration anesthesia[15–17]

LIA is the standard and most widely used anesthesia technique for no-scalpel vasectomy. The purpose is to block the vasal nerve. This technique uses 25 to 27-gauge needle, filled with 3-4 ml of 1-2% lidocaine or mepivacaine. After a single superficial skin wheal is made at the juncture of the medial and superior third of the scrotum, the needle is moved deeper upwards up to external inguinal ring and then 2-3 ml of anesthetic solution is injected. The no-scalpel vasectomy procedure can be started 2-3 minutes after anesthesia.

Three literatures were explored LIA as an anesthetic method for no-scalpel vasectomy. This technique was compared to three other anesthesia techniques,

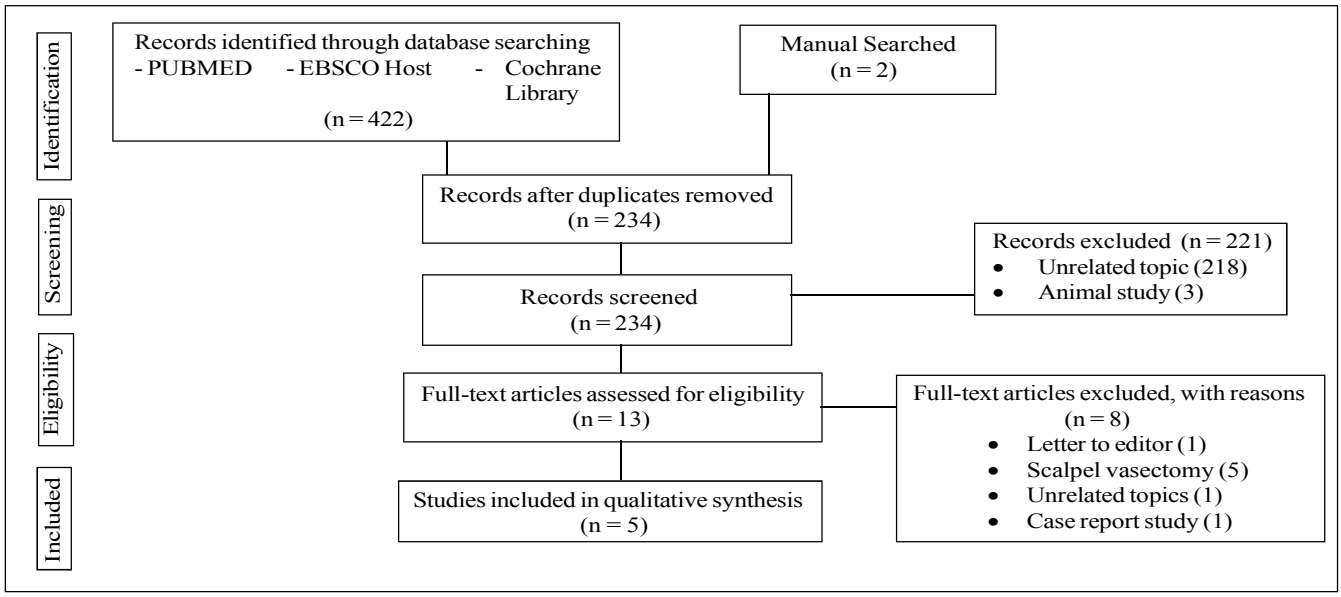

Figure 1. Study Flow Diagram

Table 1. Summary of Current Anesthesia Methods for No-scalpel Vasectomy

Author and year of publication	Type of study	Type of anesthesia method	Description of anesthesia method	n	Results
Aggarwal, *et al.,* 2008	OS	LIA	Blockage of vassal nerve using 2-3 ml of 1% lidocaine with 1.5 inch-long 25-gauge needle.	65	• Average pain score during anesthesia (VAS 1-10): - LIA: 3.3 ± 2.3;
		LIA + SCB	Injection of spermatic cord with 4 ml of 1% lidocaine with 1:100,000 epinephrine and 0.5% Marcaine equally mixed. It continued with LIA.	29	- LIA + SCB : 1.7 ± 1.6; - NNA : 2.2 ± 1.9 ($p < 0.01$ for LIA vs LIA + SCB; $p < 0.01$ for LIA vs NNA; $p > 0.01$ for LIA + SCB) *.
		NNA	Used MadajetXL in accordance with its manual guideline.[1] The filling chamber was filled with 4 ml of 2% lidocaine.	227	• Average pain score during operative period (VAS 1-10): - LIA : 2.7 ± 2.6; - LIA + SCB : 0.64 ± 1.2; - NNA : 2.13 ± 2.0 ($p < 0.01$ for LIA + SCB vs LIA and NNA; $p > 0.01$ for LIA vs NNA) *
Shih, *et al.*, 2010	OS	MNA	Blockage of vassal nerve using 2 ml of 2% lidocaine with 3 ml syringe and 1 inch-long 30-gauge needle.	227	• VAS 1-10 (mean ± SD) during anesthesia and intra operative were 1.5 ± 1.6 (95% CI 1.3 – 1.7); 0.6 ± 1.0 (95% CI 0.5 – 0.7) respec tively
Thomas, *et al.*, 2008	NRCT	EMLA + LIA	It was applied on the entire scrotum skin 1 hour before LIA using 1% lidocaine with 0.5 inch-long 25-gauge needle and surgery was performed.	178	• Average pain score during operative period (VAS 1 – 100): - EMLA group: 21.5- non - EMLA group: 21.0 ($p = 0.8$).
		LIA	Blockage of vassal nerve using 1% lidocaine with 0.5 inch-long 25-gauge	138	
Weiss, *et al.*, 2005	OS	NNA	Used MadajetXL in accordance with its manual guideline.[1] The filling chamber was filled with 4.5 ml of 2% lidocaine without epinephrine.	465	• Average pain score during anesthesia (VAS 1-10): 1.71 (range 0-7.4, median 1.3) • Average pain score during operative period (VAS 1-10): 0.66 (range 0-6.6, median 0.2)
White, *et al.*, 2007	RCT	NNA	Used MadajetXL in accordance with its manual guideline.[1] It was filled with 0.3 mL of 2% lidocaine with 1:1,000,000 epinephrine.	50	• Average pain score during anesthesia (VAS 1-10): - NNA : 1.56 (range 0-5) - LIA : 2.12 (range 0-6) ($p = 0.029$) **.
		LIA	Blockage of vassal nerve using three 1.7-ml of mepivacaine with 27-gauge needle.	50	• Average pain score during operative period (VAS 1-10): - NNA : 1.68 (range 0-7) - LIA : 1.86 (range 0-9) ($p = 0.66$) **

OS – observational study; RCT – randomized controlled trial; NRCT – non-randomized controlled trial; LIA – local infiltration anesthesia; SCB – spermatic cord block; NNA – no needle anesthesia; MNA – mini needle anesthesia; EMLA – eutectic mixture of local anesthetic; VAS – visual analog scale; * $p < 0.01$ considered statistically significant); **$p < 0.05$ considered statistically significant)

which were combination of LIA and SCB, NNA and combination of LIA and EMLA. Those studies showed that LIA was the weakest anesthesia compared to other methods for no-scalpel vasectomy with average score of pain (VAS 1-10) ranged from 2.12 – 3.3 during anesthesia and 1.86 – 2.7 during operative period. For comparison with other types of anesthesia, see Table 1.

Table 2. Quality Assessment for obServational Studies

Description		Aggarwal, et al., 2008	Shih, et al., 2010	Weiss, et al., 2005
1	Was the research question or objective in this paper clearly stated?	Y	Y	Y
2	Was the study population clearly specified and defined?	Y	Y	Y
3	Was the participation rate of eligible persons at least 50%?	NC	NC	NC
4	Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	NC	Y	NC
5	Was a sample size justification, power description, or variance and effect estimates provided?	N	N	N
6	For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	Y	Y	Y
7	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	Y	Y	Y
8	For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	Y	Y	Y
9	Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y
10	Was the exposure(s) assessed more than once over time?	N	N	N
11	Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Y	Y	Y
12	Were the outcome assessors blinded to the exposure status of participants?	NC	N	N
13	Was loss to follow-up after baseline 20% or less?	N	N	N
14	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure (s) and outcome(s)?	NC	NC	NC

Y – yes; N – no; NC – unclear

Table 3. Quality Assessment for Interventional Studies

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other biases
Thomas, et al., 2008	N	N	N	NC	N	N	N
White, et al., 2007	Y	NC	Y	Y	N	N	N

Y – yes; N – no; NC – unclear

Spermatic Cord Block[16]

SCB is done using 5 inch-long 30-gauge needle filled with 4 ml of 1% lidocaine with 1:100,000 epinephrine and 0.5% Marcaine equally mixed for each vas. A needle is injected into spermatic cord by grasping root of scrotum between the left thumb and index finger. The operator should do incremental 20^{o} of angle readjustment following each injection through spermatic cord to reach the entire cross-section of the spermatic cord and its surrounding rim.

Only one observational study discussed SCB for no-scalpel vasectomy anesthesia technique. In this study, use of SCB was in combination with LIA. This study showed superiority of LIA-SCB combination compared to LIA alone and no-needle anesthesia with average score of pain (VAS 1-10) was 1.7 during anesthesia and 0.64 during operative period.

No-needle Anesthesia[15,16,18]

NNA is performed using a specific tool called The MadaJet. This tool has been used widely in the fields of dentistry and dermatology. A 4 ml of 2% lidocaine without epinephrine is filled into its cham-

ber. Furthermore, injection is done on three places. The first injection is placed at the median raphe at the junction of superior and medial third of the scrotum and two subsequent injections are placed 3-5 mm inferiorly from the previous injection. The no-scalpel vasectomy procedure can be started after 1 minute of waiting.

There were one interventional and two observational studies which discussed NNA for no-scalpel vasectomy. Two studies showed that NNA was better anesthesia during injection of anesthesia solution. However, no significant difference was found in term of pain during no-scalpel vasectomy procedure between NNA and LIA. Furthermore, one study showed that NNA had similar effect to combination of LIA and SCB during anesthesia, but weaker effect during procedure. This method had average score of pain as much as 1.56 – 2.2 during anesthesia and 0.66 – 2.13 during no-scalpel vasectomy procedure.

Mini Needle Qnesthesia[19]

This technique basically is a LIA, but using smaller needle, which is a 1-inch 30-gauge needle. The needle is filled with 2 ml of 2% lidocaine and injected toward median raphe at midway between base of penis and top of the testis. As in LIA, superficial skin wheal is made before continuing to infiltrate the anesthetic solution into desired vas.

There is only one observational, no control study discussing mini needle anesthesia for no-scalpel vasectomy. This method average pain score was 1.71 during anesthesia and 0.66 during no-scalpel vasectomy procedure.

EMLA[17]

EMLA is a mixture of 2.5% lidocaine and 2.5% prilocaine which is used by applying it over the skin. This mixture is applied one hour before procedure begins. One non-randomized controlled study showed average score of pain as much as 2.15 during operative period for combination of LIA and EMLA. However, this study did not state the average score of pain during anesthesia procedure.

Discussion

This study tried to explore current available anesthesia methods for no-scalpel vasectomy procedure. Several studies were found in correspond to the topic above and discussed the following anesthesia technique: LIA, combination of LIA and SCB, NNA, MNA, and combination of LIA and EMLA.

LIA has been known as the standard anesthesia technique and still the most widely used for no-scalpel vasectomy anesthesia.[20] This study showed that combination of LIA and SCB is superior compared to LIA alone, not only during anesthesia, but also during the no-scalpel vasectomy procedure. However, this was based on only one observational study. Even though the study was well conducted, it is still not considered as high level of evidence.[21] SCB is an anesthesia technique which was used to facilitate hydrocelectomy, orchiectomy, and vasectomy reversal. Even though results section explained that this anesthesia technique is done through grasping the root of scrotum and injected it, other study showed that the landmark for injection is a point 1 cm below and medial to the pubic tubercle. However, today, this technique is more often done with USG-guided.[22]

Mini-needle anesthesia technique also showed promising result with very low average score of pain during anesthesia and intraoperative. Unfortunately, these results were not compared to standard or other anesthesia technique and was an observational study.

No-needle anesthesia technique using MadaJet for no-scalpel vasectomy was discussed by three studies with one of studies was a high-quality conducted RCT. Other two studies were observational and one of them was not a comparative study. However, both of RCT and observational comparative studies showed similar results. Both studies showed that NNA had lower average score of pain during introduction of anesthesia compared to LIA, but had similar effect during no-scalpel vasectomy procedure.

There was only one study evaluated EMLA in no-scalpel vasectomy procedure and this study that showed addition of EMLA to LIA did not have any beneficial effect compared to LIA alone. Nevertheless, this study did not explore the effect of EMLA during anesthesia process which may reduce pain sensation during introduction of needle to conduct LIA.[9]

This study found that there were only few studies available regarding current anesthesia methods for no-scalpel vasectomy and most of them are observational studies. Even though the results showed that there were several options for no-scalpel vasectomy anesthesia methods and some of them proved to be better than the current standard and most widely use method, LIA, they still should be proven further by conducting more randomized controlled trial studies with more subjects.

Conclusion

LIA, combination of LIA and SCB, NNA, MNA and combination of LIA and EMLA were the current available anesthesia methods for no-scalpel vasectomy which have been studied until today. Combination of LIA and SCB, NNA and MNA showed promising results as anesthesia methods. However, these promising results should be further proven by more studies.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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