Protocol: Methodology for measuring intraoperative blood loss - a scoping review

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Protocol: Methodology for measuring intraoperative blood loss - a scoping review

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Abstract

Background: At present, there is no standardized method for measuring intraoperative blood loss. Rather, the current data on existing methods is very broad and opaque. In many cases, blood loss during surgery is estimated visually by the surgeon. However, it is known that this type of method is very prone to error. Accordingly, better standardized methods are needed.

Objective: We are planning to conduct a scoping review with the aim of presenting the currently available methods for measuring intraoperative blood loss. This should help to capture the current status and map and summarize the available evidence for measuring blood loss to identify any gaps.

Methods: Our review will be based on the PRISMA guidelines. [1] We will search the Pubmed (Medline) and Cochrane Library databases. Studies published in the period from 2012 (01.01.2012) up to and including the end of 2023 (31.12.2023) will be included. Only publications in German and English will be considered. All clinical studies that define "blood loss" as a target criterion or as a primary or secondary endpoint will be included as study types.

Results: The included studies will be listed in a database and the following basic data will be extracted: Title, year of publication, country, language, study type, surgical specialty, type of procedure. The number of participants will be listed and the distribution of the participants will be documented in terms of gender and age. The following outcomes will be extracted: measurement method, "blood loss" as primary or secondary outcome.

Conclusions: Currently, there is no comparable review, resulting in ambiguous data regarding the prevailing measurement methods. The aim of this study is to provide a comprehensive overview - from methods of measurement to various formulas for calculating losses - and to establish a status quo. This could then serve as a foundation for further studies.

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Original Manuscript

Protocol: "Methodology for measuring intraoperative blood loss - a scoping review"

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Conclusion: Currently, there is no comparable review, resulting in ambiguous data regarding the prevailing measurement methods. The aim of this study is to provide a comprehensive overview - from methods of measurement to various formulas for calculating losses - and to establish a status quo. This could then serve as a foundation for further studies.

Keywords: intraoperative blood loss; methods; estimation of blood loss; haemorrhage; measurement

methods; surgery;

Introduction

Every year, around 313 million operations are performed worldwide [2]. Intraoperative blood loss plays a very important role in the outcome of the patient in terms of perioperative morbidity and mortality [3]. There is currently no standardized method for recording (measuring and/or estimating) blood loss.

One common method, for example, is visual estimation using collection containers, abdominal drapes and blood on the floor. The addition of irrigation fluid often leads to incorrect estimates of the amount lost, which can result in overestimates and underestimates by a factor of 2-3. Even longer professional experience did not provide any advantages in terms of a more accurate estimate [4]. Thus, the inaccuracies of the visual method and the consequences of misjudgment are well known. Nevertheless, visual estimation continues to persist due to the low effort and low costs involved [5].

To counteract this inaccuracy, newer methods have been developed, such as photometry [6]. Mathematical formulas for calculating blood loss are also available, some of which have been modified over the years or established from scratch [6, 7]. Examples include the Gross equation [8], the Nadler formula [9] and the Meraculi equation [10]. For example, the Gross formula calculates blood loss by multiplying the patients blood volume by the initial hematocrit minus the minimum hematocrit divided by the average of the two latter values. The patients blood volume can either be estimated or determined using the Nadler formula. Meraculi's formula also calculates the blood loss using the patients blood volume multiplied by the initial respektively postoperative hematocrit. The first value is then subtracted from the latter. However, the formula takes into account transfusions, which are added. The reason is that the formula was initially described for a better transfusion strategy during operations.

Currently, however, the situation of the existing measurement methods and formulas has become very opaque - especially with regard to newly developed methods.

However, the precise determination of blood loss forms the basis for improving surgical management and patient care - as well as the comparability of different surgeons, centers, surgical methods and patient populations.

The aim of this scoping review is to provide an exploratory overview of the extent to which the methodology has been named in clinical studies (randomized-controlled trials, and others) with the

endpoint or target criterion "intraoperative blood loss". This is intended to help record the current status and map the available evidence, but without going into the individual measurement methods in an evaluative manner. Our study, in contrast to those currently available, is intended to cover all specialties. This makes it possible to capture and classify the broad spectrum of surgery and surgical procedures. It summarizes the available evidence base for measuring blood loss in order to identify any gaps and can serve as a starting point for further studies.

Methods

We are going to base our review on the current PRISMA guidelines. [1] The search will be conducted in the two databases PubMed (Medline) and Cochrane Library. We will limit the search to a period of the last 11 years. Therefore, studies published in the period from 2012 (01.01.2012) up to and including the end of 2023 (31.12.2023) will be included. Additionally, we will only include publications in English and German. Only clinical studies that measured "blood loss" as a target criterion or endpoint will be included as study types. This means, we will limit the study types to the following: clinical studies, clinical trials, randomized controlled trials (RCT), observational studies (in line with PubMed definition of article types). Consequently, all other study types (such as case reports or reviews) will be excluded. The reason is that such studies do not measure an endpoint such as blood loss and therefore we cannot extract a measurement method.

Study participants:

Only studies that include humans as study participants will be considered. Therefore, studies in which animals were used as study participants or in which experiments were conducted on animals will be excluded.

Search strategy:

In order to pursue the research question, a search strategy was developed using the PICO scheme. We will proceed as follows.

Primarily, the databases will be studied using this standardized search. Supplemental material 1 shows the search strategy which will be used in PubMed (Medline). The same search strategy will be used for the Cochrane Library, which can be found in supplemental material 2.

Secondarily, the bibliographies of the included studies will be manually searched for further suitable articles. The abstracts will be read independently by two authors and will be evaluated with regard to the inclusion and exclusion criteria. Differences of opinion between the authors will be settled by

mutual agreement. If no agreement can be reached, a third reviewer will evaluate the study and decide for inclusion or exclusion. The decision-making process in the literature search and the selection of studies will be supplemented by a flow chart in the final report (see supplemental material 3). During the selection process, the studies will be extracted separately by the two authors and will be collected in a separate database.

The inclusion and exclusion criteria are summarized in table 1.

Table 1: Inclusion and Exclusion Criteria

	Inclusion Criteria	Exclusion Criteria
Database	Pubmed Cochrane Library	------
Article or study type	Randomized Controlled Trial Clinical Study, Clinical Trial Observational study	Reviews Case reports Case series with less than 5 patients Commentaries Letters
Study Population	Humans	Animals
Reported Outcomes	Primary Outcome: • Measurement method for intraoperative blood loss Secondary Outcomes: • Measurement method unknown (study that measures blood loss but does not specify a method) • “Blood loss” as primary or	

	secondary outcome	
Language	English	Other language
	German	

Data extraction

The included studies will be listed in a database and the following basic data will be extracted: Title, year of publication, country, language. The number of participants will be listed, and the distribution of the participants will be documented in terms of gender and age. For better evaluation and comparability, we will divide the age into groups: Infants (up to the age of 3), children (age 4 to the age of 12), adolescents (age 13 to the age of 18), young adults (age 19 to the age of 30), adults (age 31 to the age of 60), older adults (age 61 to the age of 80) seniors (age 81 and above).

Finally, the following results will be extracted:

- Study type
- Surgical specialty
- Type of surgery
- Measurement method
- “Blood loss” as primary or secondary outcome

A preselection will be made for the respective points below.

Study type:

a) Intervention study

a. Randomized Controlled Trial – RCT,

b. Controlled Clinical Trial - CCT

b) Observational study (case-control study, cohort study)

a. Prospective,

b. Retrospective

Surgical specialty:

a) Vascular surgery

b) Trauma surgery and orthopaedics

c) Thoracic surgery

d) Visceral surgery

e) *Plastic surgery*
f) *Pediatric surgery*
g) *Cardiac surgery*
h) *ENT surgery*
i) *Neurosurgery*
j) *Gynecology*
k) *Urology*
l) *Oral and maxillofacial surgery*
m) *Eye surgery*
n) *Endocrine surgery*
o) *Spinal surgery*
p) *Multidisciplinary interventions*
q) *Emergency general surgery*

Type of procedure: *Name of the operation e.g. "Appendectomy"*

Measurement method:

a) *Visually estimated/ bleeding scores (specify the score)*
b) *Measured using measurement data (specify the method used)*
c) *Calculated using a formula (specify the formula used)*
d) *Unknown*

Blood loss as outcome/ parameter:

a) *Primary outcome*
b) *Secondary outcome*
c) *Not defined as an outcome, but one of the target criteria of the study*

In the event that a study does not differentiate outcomes directly into primary and secondary endpoints, the outcomes are all considered "primary" and will be included in our scoping review, too.

Data collection

The results will be collected in a database and will be presented in tabular form. For a better overview, the data will be grouped according to the type of method (measurement methods, estimation methods, calculation methods). The data summary facilitates the comparison of evaluation methods and the identification of dependencies. It allows for an assessment of the methods in terms

of their precision and required effort. Additionally, it will help to uncover patterns, such as the prevalence of certain methods in various surgical specialties. Questions can be explored, like whether there's a link between the complexity or accuracy of a method and the time of publication or the quality of the study (e.g., randomized versus observational studies). These aspects, among others, present opportunities for comparison. Moreover, this approach provides a chance to pinpoint any existing gaps and propose ideas for standardization.

Discussion

Currently, the measurement of intraoperative blood loss lacks clarity due to the absence of standardized methods. A variety of methods are employed in practice, often with personal modifications. This inconsistency extends to the formulas used for calculating blood loss. Such variability could pose challenges for our scoping review, particularly in categorizing the methods used in different studies. Additionally, there is a potential for bias if multiple studies fail to detail their measurement methods. To mitigate this issue, we plan to include these studies in our collection and consider this factor in our analysis.

Conflicts of Interest

none declared

Abbreviations

JMIR: Journal of Medical Internet Research
RCT: randomized controlled trial
CCT: controlled clinical trial

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List of tables

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Supplementary Files

Multimedia Appendixes

search strategy PubMed.
URL: http://asset.jmir.pub/assets/5a34df5b294d92e5f643e0a777374cb2.docx

search strategy Cochrane Library.
URL: http://asset.jmir.pub/assets/9c89a3d366b451577c3bb1e298ed880a.docx

PRISMA 2020 flow diagram.
URL: http://asset.jmir.pub/assets/52d6990c55035c0a76496e7497874905.docx