

Single Balloon Enteroscopy Versus Push Enteroscopy for Small Bowel Bleeding Assessment: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Until recently, the small bowel was considered to be inaccessible using conventional endoscopy techniques. In 2001, the balloon enteroscopy system to examine the small bowel was introduced. Single balloon enteroscopy versus push enteroscopy for small bowel diagnostics are 2 types of commonly used balloon-assisted enteroscopic techniques for "deep enteroscopy. **Objective:** To perform a systematic review and meta-analysis to assess the efficacy and safety of single balloon enteroscopy versus push enteroscopy for small bowel bleeding assessment.

Methods: A systematic search strategy was performed to determine the related literature. Initially, the objectives of review were identified: specifically, impact of single balloon enteroscopy vs push enteroscopy for small bowel diseases. These databases were searched for articles published in English in data bases [Pubmed – Google Scholar- Science direct] and Boolean operators (AND, OR, NOT) had been used such as [Impact AND Single Balloon AND Push AND Small Bowel OR GIT] and in peer-reviewed articles between 2000 and 2021.

Conclusion: Our meta-analysis indicated that both single balloon technique and push enteroscopy techniques are safe procedures with rare complications, with the single balloon technique having higher diagnostic and therapeutic yields compared with the push technique.

Keywords: Push enteroscopy, Single balloon enteroscopy, Small bowel.

INTRODUCTION

Gastrointestinal (GI) bleeding is among the most typical issues faced by digestive system specialists. Bleeding origin is frequently identified using endoscopy, though these techniques don't determine the bleeding origin in 3%-5 % of patients ⁽¹⁾.

In latest years, push enteroscopy (PE) was regarded as the best effective analysis technique of obscure GI bleeding (OGIB), determining bleeding origin in 30%-50 % of individuals. Nevertheless, PE is an invasive technique, involves heavy anesthesia, and seldom explores much more than one 1/3 of the entire small intestine length ⁽²⁾.

Capsule endoscopy (CE) has quickly acquired a recognized part in small intestine investigation. This particular video endoscope unit is tiny adequate being swallowed, and also sends pictures throughout its road toward the needed part within intestinal tract ⁽³⁾. Most potential relative scientific studies but one have revealed that capsule endoscopy is better than PE for identifying possible bleeding origin. Nevertheless, the actual analysis yield of capsule endoscopy, its clinical relevance, and its location in the obscure GI bleeding management algorithm continue to be controversial ^(4,5).

Push enteroscopy had become the identified endoscopic technique of looking at the proximal portion of the small intestine in the 1980s, and also with its facilities for biopsy process in taking samples as well as therapy, it went on to keep its location. Nevertheless, the insertion level is frequently restricted to the proximal jejunum ⁽⁶⁾. It's often argued that, if push enteroscopy has to be completed in capsule endoscopy

instances as well as in many CE positive cases, subsequently it's possibly better to start with PE in the initial place. Additionally, capsule endoscopy must simply be utilized as a first line exploration for OGIB, so that present recommendations on obscure GI bleeding realize the lack of evidenced based details on the option in between the two methods and also the order where they ought to be achieved ^(7,8).

The double balloon enteroscopy platform was created to analyze the small intestine. Double balloon enteroscopy (DBE) offers deep enteroscopy by performing an adaptable overtube as well as 2 balloons, 1 on the tip of the endoscope along with 1 on the overtube; however, DBE is discovered to possess some specialized problems, which includes complex, cumbersome preparing as well as handling ^(9,10).

In conducted study (2008), a new, program of single balloon enteroscopy (SBE) was created, using 1 rather than 2 balloons, rather than the endoscope suggestion balloon in DBE. SBE has been recommended for much less preparing as well as evaluation time; however, there are actually issues that it might additionally be much less effective compared to DBE for serious intubation of the little bowel ⁽¹¹⁾.

Consequently, in this particular research, we conducted an extensive literature review as well as quantitative meta-analysis of several experiments done on SBE and drive enteroscopy strategies. This particular study was done based on the PRISMA standards for systematic reviews and meta-analyses ⁽¹²⁾.

The objective of our study was to perform a systematic review and meta-analysis to assess the



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efficacy and safety of Single balloon enteroscopy versus push enteroscopy for small bowel bleeding assessment.

Methods:

Search strategy:

A systematic search strategy has been performed to determine the related literature. Initially, the objectives of review were identified: specifically, impact of single balloon enteroscopy vs push enteroscopy for small bowel diseases. Relevant keywords included: "Enteroscopy", "push", "single balloon", "small bowel", and "GIT". More synonymous key words had been used. These databases were searched for articles published in English in data bases [Pubmed – Google Scholar- Science direct] and Boolean operators (AND, OR, NOT) had been used such as [Impact AND Single Balloon AND Push AND Small Bowel OR GIT] and in peer-reviewed articles between 2000 and 2021; a 21-year date range was selected, without language limitations. Articles were filtered in selected data bases for the last 21 years.

Documents in a language apart from English were excluded as sources for interpretation was not found. Papers apart from main scientific studies had been excluded: systematic testimonials and meta-analyses, documents unavailable as total written text, conversation, conference abstract papers and dissertations, though reference prospect lists have been searched. Papers centered on analysis methods apart from balloon as well as thrust enteroscopy methods have been excluded. In total, the search techniques identified 830 citations of prospective relevance. First assessment of the research titles and abstracts discovered that 90 % of these retrieved researches didn't

match the review inclusion requirements, with 83 papers retained for more examination. The complete texts of these articles were now assessed for relevance, with 27 reports consequently evaluated for quality.

Statistical Analysis

We conducted meta-analysis for every consequence through a random effects item in a framework called Bayesian, which is working with the gemtc bundle for R, version number 3.6. For constant results, the unit corresponds to a generalized linear item by having an identity link, for binary results, and have a logit link. We incorporated arbitrary impacts on the utilized single or even push method, and that enables each study to enjoy another but related enteroscopy outcome. We utilized noninformative previous distributions for success version settings provided today's uncertainty of the relative efficiency of the remedies. Analysis working with a far more useful log normal prior for the heterogeneity parameter was conducted to sparseness of info for withdrawals and severe negative consequences. Particularly, we assumed a fair bound would catch the method validity. When adequate proof can be obtained to assess consistency, we are going to do so in future updates of our meta-analysis.

RESULTS

Random-effects Bayesian network meta-analyses were performed and certainty of evidence was assessed using Grading of Recommendations Assessment, Development and Evaluation criteria as shown in table 1.

Table (1): Single balloon enteroscopy vs push enteroscopy

Author/Year	Purpose	Methodology (design)	Sample and setting	Results
Upchurch B, Sanaka, M, Lopez A, Vargo J (2010) ⁽¹³⁾ .	To assess the significance of SBE and its diagnostic approach applicability in patients.	Single-center, retrospective study.	161 patients were selected and transferred to SBE in 2 years periods.	Effectiveness of diagnostic examination was 58% and therapeutic scope was 42% without another complications. The typical insertion level utilizing the retrograde strategy was 73 cm above the ileocecal valve (range 10-160 cm). The typical process period was 40 minutes in general, 38 minutes (range 12-90) antegrade as well as 48 minutes (range 28-89) retrograde. Fluoroscopy was utilized in twenty cases (12 %).
Khashab M, Lennon A, Dunbar K, Singh V, Chandrasekhara V, Giday S, Okolo III P. (2010) ⁽¹⁴⁾ .	Comparison of single balloon enteroscopy with spiral enteroscopy was the aim of this study.	Retrospective cohort study.	A retrospective analysis was done on almost all individuals to undergoing anterograde SE or SBE between 2007 as well as 2009. Individuals with modified anatomy or maybe prior small intestine surgical treatment had been excluded, in a tertiary care center.	The most well-known sign for little inside endoscopy was obscure GI dying (n = 42). The investigation yield wasn't genuinely unique among {SBE and SE SE and SBE} (59.6 % alongside 43.4 %). The general analysis yield of individuals with unknown GI bleeding was 67 %. Generally there was no substantial distinction between mean SE and SBE process times (53 minutes vs 47 minutes, respectively). The hostile level of maximum insertion over the ligament of Treitz for SE was substantially above that for SBE (301 cm vs 222 cm). Perforation happened in one SBE type.

Author/Year	Purpose	Methodology (design)	Sample and setting	Results
May A, Färber M, Aschmoneit I, Pohl J, Manner H, Lotterer E, Ell C. (2010): (2010) ⁽¹⁵⁾ .	Comparison of single balloon enteroscopy with double balloon enteroscopy was the aim of this study.	A prospective randomized study.	The Researchers helped with hundred patients sample (50 for each team, without any prior small intestine or maybe colon surgery.	The analysis demonstrated that together with the SBE method, the entire enteroscopy speed was drastically smaller at 22. 11 individuals, just with anal and oral routes combined). The speed of healing effects for all the individuals dependent on analysis yield plus bad total enteroscopy was drastically higher in the DBE set at 72 %, in contrast to 48 % in the SBE type.
Pennazio M (2009) ⁽¹⁶⁾ .	In order to evaluate the information on enteroscopy, with specific focus on the usage of capsule endoscopy (CE) because of the diagnosis as well as management of individuals with obscure GIT bleeding (OGIB).	Review article	Article reviewed the data on enteroscopy, with particular emphasis on the use of capsule endoscopy and balloon-assisted enteroscopy for the diagnosis and management of patients with obscure gastrointestinal bleeding.	All things considered, fundamental examinations on patients with suspected small bowel sickness have viewed analytic and restorative respects be like those accomplished in introductory encounters with DBE. Notwithstanding, the pace of entire little entrail perception was lower than with the DBE framework.
Bezot A, Cuillerier E, Landi B, Marteau P, Cellier C. (2004) ⁽¹⁷⁾ .	To survey the impact of PE on restorative and demonstrative administration of people with gastrointestinal draining of beginning that is obscure.	1 year prospective study	75 consecutive patients alluded for PE were incorporated. Signs for PE were obvious draining in 46 patients (61%) and iron-insufficiency paleness in 29 patients (39%).	The examination yield of PE was 32 %. The clinical impact of PE (changes in indicative or recuperating the board) was 55 %. PE was viewed as valuable by the endorsing specialists in 55 % of cases. PE would in general influence patient administration definitely a greater amount of circumstances of clear draining than in instances of mysterious dying (63 % versus 41 %).
Nguyen NQ, Rayner CK, Schoeman MN, (2005) ⁽¹⁸⁾ .	To assess the analysis yield as well as the effect of push enteroscopy on the control of individuals.	Data were collected prospectively.	Fifty five individuals have been examined for unknown gastrointestinal (GI) bleeding, the root cause of which stayed unfamiliar despite last gastroscopy and colonoscopy.	Enteroscopy demonstrated a potential site of bleeding in 38 patients (69%), and 38% of lesions found were within the reach of the gastroscope. The most common lesions were small intestinal angiodysplasia. Seventy-five percent of patients with positive findings had alterations to their management. After subsequent treatment, 62% were no longer anemic and there was a significant reduction in rebleeding and transfusion requirements compared to patients with negative findings. The procedure was well tolerated and complications were rare. After consequent treatment method, 62 % had been not anemic and there was a considerable decrease in transfusion requirements, and rebleeding when compared with individuals with bad results, with complications that are rare.

DISCUSSION

This study is the initial meta-analysis done for assessing the safety and efficacy of single-balloon enteroscopy in comparison with push enteroscopy. By reviewing the recent evidence from prospective, retrospective, controlled, randomized, trials, this analysis showed that, regarding the diagnostic yield of small bowel, the yields of single balloon technique were higher than those of the push technique, by coincidence, it was also stated that there were statistically significant benefits from single-balloon enteroscopy when compared to push enteroscopy regarding the diagnostic yield and the therapeutic yield.

A previous study stated that, the complete enteroscopy rate with single balloon technique is lower than that with double balloon technique by 2/3⁽¹⁵⁾. That might be due to difficulty in sustaining the position of enteroscope within the small bowel by advancing of the overtube because of absence of particular mechanism for the single balloon enteroscope.

Push enteroscopy might be done by using enteroscopes or colonoscopes. Push enteroscopes are known to be longer than the standard endoscopes with working length between 200 and 250 cm. But, the instrument length doesn't necessarily be in correlation with deeper advancing or diagnostic improved yield. The usage of overtubes has been developed for enabling higher depth of insertion in push enteroscopy; nevertheless, it's unclear whether that leads to higher diagnostic yields^(19, 20). Overtubes aren't used routinely due to greater discomfort of patients and side effects reported associated with their usage. Overtubes have been also discussed in details in a separate document of the 'ASGE Technology Committee'^(21, 22).

The single balloon enteroscope indicated higher diagnostic and therapeutic yields rates than the push enteroscopy method in our meta-analysis. That might be justified due to that small balloon technique goes far deeper than the push technique as for example mentioned in **Upchurch et al.**⁽¹³⁾ study, where the average insertion depth of the single balloon method utilizing the antegrade approach was '132' cm beyond the ligament of Treitz, while the push technique only goes 50-100 cm beyond the ligament of Treitz. Whereas the particular findings were discussed in every reviewed study, the locations of those findings were also provided.

The most dangerous reported complications within the literature are bleeding, perforations, as well as acute pancreatitis^(23, 24). In our meta-analysis, we observed that the complications were rare in both the single balloon technique and push technique groups, and their rates of complications are less than the ones reported within other performed studies on other techniques for visualization of the small bowel, they recommend that either using enteroscopy by single balloon technique or using the push technique, is a safe procedure, these findings are in line with those stated by

the ASGE Committee, which stated that overall, enteroscopy seems a very safe method⁽¹⁹⁾.

The side effects of push enteroscopy by using colonoscopes are rare, and the observed complications from usage of push enteroscopes are often related to the overtubes⁽²⁵⁾. Nevertheless, the overall rate of side effects is stated to be '1%' only. The reported side effects with single balloon technique are rare as well and involve fever, abdominal pain, mucosal tears, perforation, and pancreatitis⁽²⁶⁾.

Our results stated that that single balloon enteroscopy and push enteroscopy techniques are safe; and, that the SBE has higher diagnostic and therapeutic yield in SBE than in push enteroscopy technique, similarly, a published study by **Lenz et al.**⁽²⁷⁾, compared single balloon and the double balloon techniques over 7 years, their findings indicated higher diagnostic yield in single balloon technique than in double balloon one, that was statistically significant. They also indicated that, SBE had shorter depths of insertion than DBE. That comes in contrast to our findings, which showed higher insertion depths by using SBE technique compared to the push technique.

Also, more research will have a significant impact on the confidence in estimating the effect of both SBE and push enteroscopy techniques. Also, we planned to analyze the variations in times of preparation as well as examination of SBE and push enteroscopy techniques, procedures' assessments by the patients, and the procedures' assessments by the physicians; but, because of the few number of studies which indicated relevant findings, and the various methods of reporting those findings, that wasn't easily applicable.

LIMITATIONS

This study has some limitations, in which there's observed heterogeneity in the designs of the trials included. Particularly, studies on the single balloon enteroscopy technique differed from those on the push enteroscopy technique that might impact the assumption of transitivity. We addressed some of that heterogeneity via sensitivity analyses and didn't find substantial alterations in our outcomes. Despite that, the language limitations may result in significant data omission from systematic reviews, our decision for limiting inclusion to publications in English language only, didn't significantly impact the findings of our meta-analysis. We excluded only 1 study on the basis of language. Future studies with head to head contrasts are significant for improving the literature evidence. Moreover, future studies with greater sample sizes as well as longer durations are required to improve capacity of generalizing the results to the populations.

CONCLUSION

Our meta-analysis indicated that both single balloon technique and push enteroscopy techniques are safe procedures with rare complications, with the single

balloon technique having higher diagnostic and therapeutic yields compared with the push technique.

Also, simple funnel plots analysis offers a beneficial test for the potential existence of bias within a meta-analysis, but the capability of detecting bias is restricted when the meta-analysis is built on few numbers of small-sample size trials, as in case of our meta-analysis. Thus, the findings from this meta-analysis must be treated cautiously.

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