Is jumbo biopsy forceps comparable to cold snare for diminutive colorectal polyps? – a meta-analysis

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ABSTRACT

Background and study aims Diminutive colorectal polyps are increasingly being detected and it is not clear whether jumbo biopsy forceps (JBF) has comparable efficacy to that of cold snare polypectomy (CSP) for management of these lesions.

Methods An electronic literature search was performed for studies comparing resection rates of JBF and CSP for diminutive polyps (≤5 mm). The primary outcome was incomplete resection rate (IRR). Secondary outcomes included failure of tissue retrieval and complication rates (post-polypectomy bleeding, perforation etc.). Leave-one-out analysis was performed to examine the disproportionate role of any of the studies. Meta-analysis outcomes and heterogeneity (I^2) were computed using Comprehensive meta-analysis software.

Results A total of 4 studies (3 randomized controlled trials and 1 retrospective study) with 407 patients and 569 total polyps (mean size of 3.62 mm) was included for analysis. IRR of JBF was slightly higher than that of CSP (10.2 % vs 7.2 %) but this was not statistically significantly different (Pooled OR 1.76; 95 % CI 0.94–3.28; $I^2 = 0$). Leave-one-out analysis showed no significant difference in the pooled OR comparison either. Two of the 4 studies reported 0 % failure of tissue retrieval for JBF and 1 % and 4.3 % for CSP. There were no complications for either group from the 2 studies that reported this outcome. The quality of the included studies was moderate to high.

Conclusions This systematic review with only limited data shows that JBF and CSP are not statistically different in completely removing diminutive polyps, although careful endoscopic assessment is needed to ensure complete removal of all polyp tissue.

Introduction

Colorectal cancer (CRC) is the 2nd leading cause of cancer in both men and women in the United States [1]. Screening colonoscopy helps to identify precancerous colorectal polyps and their prompt removal could prevent malignant transformation. According to the current guidelines, endoscopic polyp size measurement is key in determining surveillance intervals. Small (<10 mm) and diminutive (≤5 mm) colorectal polyps are the most common type of colorectal polyps found during colonoscopy especially when using higher resolution endoscopes, distal attachment devices and improvements in bowel preparation [2].

While it is known that the neoplastic potential of these small and diminutive polyps is low, studies have shown that incomplete (or inadequate) polyp resection could contribute to post

colonoscopy colon cancer in up to 30 % of patients [1]. Incomplete resection rates (IRR) of 10 % to 15 % have been reported for standard capacity biopsy forceps, cold snare (CSP) and hot snare across polyps of all sizes [3]. Studies have demonstrated that the resection rates of these diminutive polyps by hot biopsy forceps are suboptimal compared to cold techniques [4]. However, there is some degree of variation in the resection rate among cold polypectomy techniques itself. CSP appears to be safer as well as more effective than standard capacity forceps in the management of small and diminutive polyps [4].

Jumbo biopsy forceps (JBF), a type of cold forceps which in comparison to standard capacity forceps and large capacity forceps, can accommodate more polyp tissue (12.44 mm^3 vs 7.22 mm^3) and offer removal of diminutive polyps in entirety. A meta-analysis from 2016 [5] suggested that cold snare or jumbo biopsy decreased the rates of incomplete resection by 60 % without any increase in procedure time. However, none of the studies included in this analysis were from a head-to-head comparison.

Recently, some studies [6–8] have been published examining JBF to CSP for efficacy in diminutive polyp resection. However, variable rates have been reported, and it remains unclear which method is better. Since diminutive polyps are a common occurrence in screening and surveillance colonoscopy, knowledge of effective polypectomy techniques is crucial. We performed a systematic review and meta-analysis of the literature to examine the efficacy and safety of JBF and CSP in the management of diminutive polyps.

Methods

We performed this systematic review and meta-analysis in accordance with the PRISMA guidelines [9]. The search strategy for screening, excluding and final selection of studies is depicted in ▶ **Fig. 1**.

Literature search

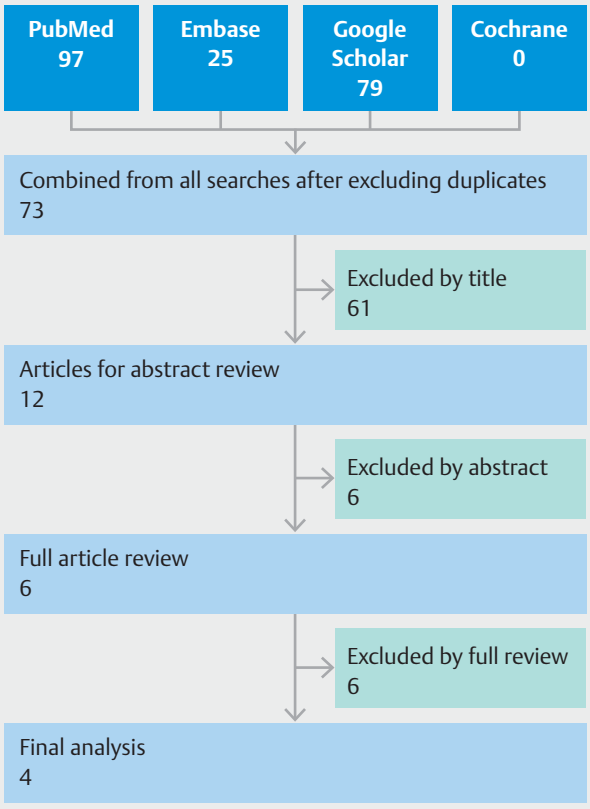
We searched online electronic libraries (PubMed, EMBASE, Web of Science, Google Scholar) until February 1st, 2020 for studies comparing JBF and CSP and resection of diminutive colorectal polyps. The following keywords “jumbo biopsy forceps”, “cold snare polypectomy”,” small polyps” and “diminutive polyps”.

Eligibility

We primarily included articles that reported dimunitive polyp resection data using jumbo biopsy forceps AND cold snare (*inclusion criteria)*. Case reports, case series, cross sectional studies and review articles were excluded for this review and analysis.

Screening and data collection

Articles were screened and data was extracted by one reviewer (SS) and verified independently by another reviewer (MD). Duplicate studies were excluded, and titles/abstracts were screened for study of interest. Only articles that met eligibility were included for final review and analysis



▶ **Fig. 1** Search schematic for review and inclusion of articles.

Quality assessment of studies

Cochrane risk of bias tool [10] was used to assess the quality of RCTs while Newcastle Ottawa scale (NOS) [11] was used to examine study quality of the retrospective cohort study. Scoring was done per protocol across all the respective domains.

Definitions

Incomplete resection rate–reflects the number of polyps incompletely resected (i. e. with residual neoplastic tissue left behind) divided by the total number of polyps resected

Failure of tissue retrieval rate – rate at which the polyp/tissue attempted to be resected and retrieved was not successful

Complications – any untoward event that occurred as a direct result of the endoscopic procedure and/or related instrumentation.

Outcomes

The primary outcome of interest was the pooled IRR of JBF and CSP when treating diminutive polyps. Secondary outcomes included failure of tissue retrieval, long-term follow up outcomes and complications rates following use of either modality (post-polypectomy bleeding, perforation etc.)

Statistical analysis

Pooled estimates using proportions from each group were compared using a fixed-effects model with odds ratio (OR) and

▶ **Table 1** Descriptive characteristics of included studies.

Author	Year of publication	Type of study	Total no. of subjects	Total no. of polyps	Avg polyp size (in mm)	Males	Mean age (in years)	Incomplete resection by JBF/Total no. resected by JBF	Incomplete resection by CSP/Total no. resected by CSP
Gonzalez [8]	2010	RCT	40	66	3.3	Not reported	Not reported	4/33	1/33
Liu [12]	2012	Retrospective cohort study	47	65	4.5	Not reported	Not reported	2/18	1/7
Huh [7]	2019	RCT; Non-inferiority trial	169	177	3.9	131	61.9	7/87	7/90
Desai [6]	2019	RCT	151	261	3.3	104	63.1	16/144	9/117

RCT, randomized controlled trial.

95% CI. Leave-one-out analysis was performed to examine a disproportionate role of any single study. I^2 statistics was computed to assess for heterogeneity. Meta analytic calculations and forest plots were created by statistical software Comprehensive Meta-analysis v3 (Biostat, Englewood, New Jersey, United States]. $P<0.05$ was considered statistically significant.

Results

Characteristics of included studies

The initial search yielded 201 articles. After removal of duplicates, there were 73 articles that were eligible for review. Of these, 61 were removed after review of the title, six of the abstract and two articles were excluded after full review, respectively, since they did not meet inclusion criteria. Finally, four articles were included for review and meta-analysis.

Of the four included articles, three were RCTs [6–8], with one study as abstract only data [7] and one was a retrospective cohort study (▶ **Table 1**) [12]. One of the studies [7] had a non-inferiority study design while the others seemed to have followed convenience sampling. Another study that was included [8] was abstract only (interim data from 2010) and there was no record of a full publication.

There were 407 patients with 569 total polyps (mean size 3.62 mm) reported from the included studies. Of these patients, 81% (from 3 studies) were males with a mean age of 62.5 ± 0.8 years (from 2 studies).

Data on IRR was available from all four studies. Only two of the four studies reported data on failure of tissue retrieval and post-polypectomy complications. None of the studies had long-term follow data for review.

Primary outcome

IRR of JBF seemed to be slightly higher than CSP (10.2% vs 7.2%) but this was not statistically significantly different (Pooled OR 1.76; 95% CI 0.94–3.28) (▶ **Fig. 2**). There was no heterogeneity ($I^2=0$) among the studies included for analysis. One of the studies, Desai et al [6] contributed to nearly half of the overall analysis while the Gonzalez et al paper [8] had an OR of 4.4 comparing JBF versus CSP that was significantly different from the other studies.

We also performed a leave-one-out analysis to ensure that the results were not skewed because of a single study (▶ **Fig. 3**). There was no statistically significant difference in IRR noted with this analysis either.

Secondary outcome

Two of the four studies reported 0% failure of tissue retrieval for JBF and 1% and 4.3% for CSP ([7] and [6] respectively). None of the studies provided any long-term follow-up or rates of interval cancer following resection. The same studies reported complication (post-polypectomy bleeding, perforation) rates which were 0% in both groups.

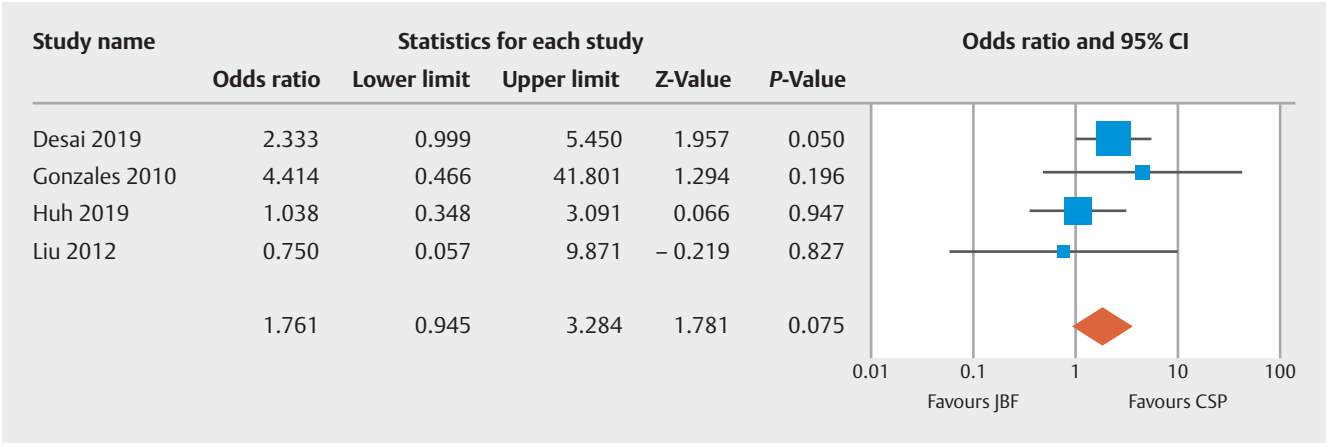
Quality assessment of the studies

All of the RCTs included were at low risk of bias for randomization, incomplete data or selective data reporting. None of the studies were blinded. The retrospective study was high (score 7) on the Newcastle Ottawa scale (▶ **Table 2**). Publication bias was not examined due to only four eligible studies.

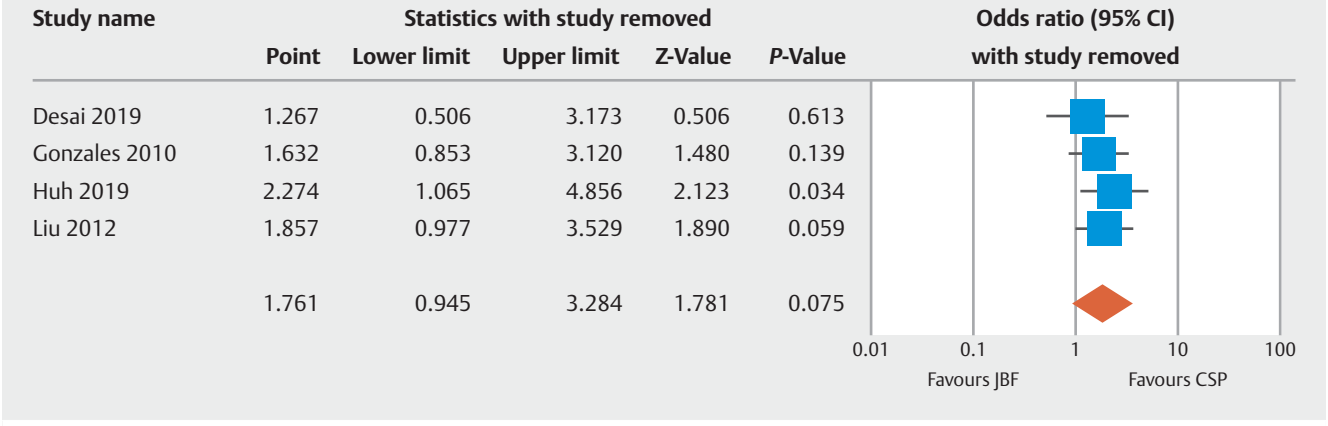
Discussion

In this meta-analysis of four available studies, there was no statistically significant difference noted in the incomplete resection rates of JBF and CSP when removing diminutive polyps. Because only three small RCTs were involved, it is too early to conclude whether either of method fares better to remove diminutive polyps or that they indeed can both be used. It is imperative to note that with either method there is a substantial incomplete resection rate (7%–10%) and careful examination of the post polypectomy site is essential even when a diminutive polyp is removed.

With the improving detection modalities (higher resolution endoscopes, artificial intelligence etc.) detection of smaller polyps is and will be increasingly seen. While it is known that the overall risk of malignant transformation of small and diminutive polyps is low (< 1%) [13], it nevertheless puts a burden on the health care system (procedure/resection cost and pa-



▶ **Fig. 2** Forest plot comparing incomplete resection rates of JBF and CSP.



▶ **Fig. 3** Leave-one-out forest plot of the included studies.

▶ **Table 2** Risk of bias for the included studies.

Cochrane risk of bias for RCT	Random sequence generation	Allocation concealment	Blinding of participants	Deviation from intended outcome	Incomplete outcome data	Selective reporting	Other bias	
Gonzalez 2010	Unclear	Unclear	No	Unclear	Unclear	Low	Unclear	
Huh 2019	Low	Low	High	Low	Low	Low	Low	
Desai 2019	Low	Unclear	High	Low	Low	Low	Low	
Newcastle Ottawa scale for observational study	**Representativeness of the exposed cohort**	**Selection of the non-exposed cohort**	**Ascertainment of exposure**	**Demonstration that outcome of interest was not present at start of study**	**Comparability of cohorts on the basis of the design or analysis**	**Assessment of outcome**	**Was follow up long enough for outcomes to occur**	**Adequacy of follow up of cohorts**
Liu 2012	*	*	*	–	*	*	*	*

RCT, randomized controlled trial.

thology expenses) in addition to the risk of complications from the procedure itself.

The safety and efficacy of CSP have been established and it is currently the most preferred modality of resection of diminutive polyps [5]. Hot forceps even though currently approved

have shown significantly higher IRR (up to 53 %) [14] making them less effective. Cold forceps fair better in comparison [14] but the literature is sparse comparing them to JBF. The wider jaw (8.8 mm) of the JBF with a better bite makes it likely to grasp more tissue and thus have a lesser IRR compared to the standard biopsy forceps [15]. This way resection margins of removed tissue could be examined better for clean resection margin to ensure adequacy of resection as well. This meta-analysis supports the comparable nature of JBF and CSP in addressing these polyps.

It is worthy of mention that one of the studies [7] intended to evaluate non-inferiority of JBF over CSP but the other studies did not have any such hypothesis. It is unclear, but unlikely that this has any impact on pooled results since results were generated using events of outcome and total subjects. However, this could play a role towards the final results as a power required to detect a non-difference could be very different from a power required to detect a difference. In leave-one-out analysis, we were not able to detect this effect, but this could still be possible.

A large number of polyps (n = 569), low heterogeneity ($I^2 = 0$) and the quality of studies included are the strength of these studies. Some of the limitations pertain to that of any meta-analysis, i. e. that it reports pooled data only and might be subject to skewing owing to some of the included studies. Another limitation is the total number of included studies (n = 4). Of these, one of the studies [8] was abstract only data and it is possible that the full text had some additional information that could change the reported results. Of the four studies that met eligibility, three were RCTs and were of reasonably high quality. While we did include a cohort study thus raising a concern for potential confounding bias, restricting the analysis to RCT alone did not change the results. We were not able to conduct further analysis of certain factors (viz. residual and recurrence rates, change in surveillance intervals and time required for effective polypectomy) because of lack of information from the included studies. There was also no information on whether polyps were removed en-bloc or use of any special techniques (lift and cut, etc.). The studies lacked information on long-term follow-up data making the above-mentioned calculations not possible. Future studies should focus on accuracy of resection methods from either technique and rate of (long-term) residual and recurrent polyp to further define their efficacy.

Conclusion

In conclusion, based on the findings, jumbo biopsy forceps seem not statistically different to cold snare polypectomy in the management of diminutive polyps. Further head to head large scale trials are necessary to find any small difference that would have been masked by prior studies with focus on diminutive polyps to avoid incomplete resection and improve quality of colonoscopy.

Competing interests

The authors declare that they have no conflict of interest.

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