

# Analyzing the Effectiveness of Extraperitoneal Route versus Transperitoneal Route of Colostomy Related Complications: Systematic Review and Meta-Analysis

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## Abstract

**Aim:** The aim of this review is to analyze the effect between extraperitoneal routes and transperitoneal route after colostomy in prevention of stoma related complications.

**Method:** PubMed, Google scholar, Web of science and Medline were searched for relevant studies regarding extraperitoneal route versus transperitoneal after colostomy related complications. Meta-analysis was performed by revman 5.3.

**Results:** Seven retrospective and one randomized controlled trial studies were included. A total of 514 patients were identified, out of which 284 extraperitoneal colostomies and 234 transperitoneal colostomies. Our investigation presented that, in the extraperitoneal group there was a significant difference of parastomal hernia (Odds ratio = 0.36 (95% CI, 0.20–0.65);  $I^2 = 40\%$ ;  $p = 0.0008$ ). However, the incident of other stoma-related complications was not significantly different between the two groups.

**Conclusion:** Colostomy creation via extraperitoneal route is more effective and it can significantly decrease the incident of parastomal hernia.

**Keyword:** Extraperitoneal, colostomy, transperitoneal, parastomal hernia, abdominoperineal resection, laparoscopic

## Introduction

The colostomy is an opening in the large intestine that creates many surgical events [1]. This cut opening happens due to the drawing of the healthy end of the large intestine with an incision in the forward abdominal wall. The opening happens with the attached stoma application, and it provides some alternative channels to remove from the body [2]. If there is no availability of natural anus for this purpose, an artificial anus must be necessary for fulfilling this job reversibly and irreversibly, where both things depend upon the circumstances. There are some indications for this procedure and the reasons are stated. Colon sections must be removed to give no exit to feces from any way out from the anus, some parts of the colon must be rested during the procedures and afterward for a few days to get heal properly [3]. There are different types of colostomies; some are loop colostomy, end colostomy, double-barrel colostomy. A loop colostomy is also referred as large stoma and proceeds at the time of emergency cases [4]. A loop is created through the abdomen and placed with the external device to cure it. A stoma that is created at the bowel end is known as end colostomy [5]. When the bowel is incised and both ends brought out from the abdomen, the process is termed as double-barrel colostomy [6]. However, past research focuses only on the transperitoneal route for the prevention of colostomy related complications.

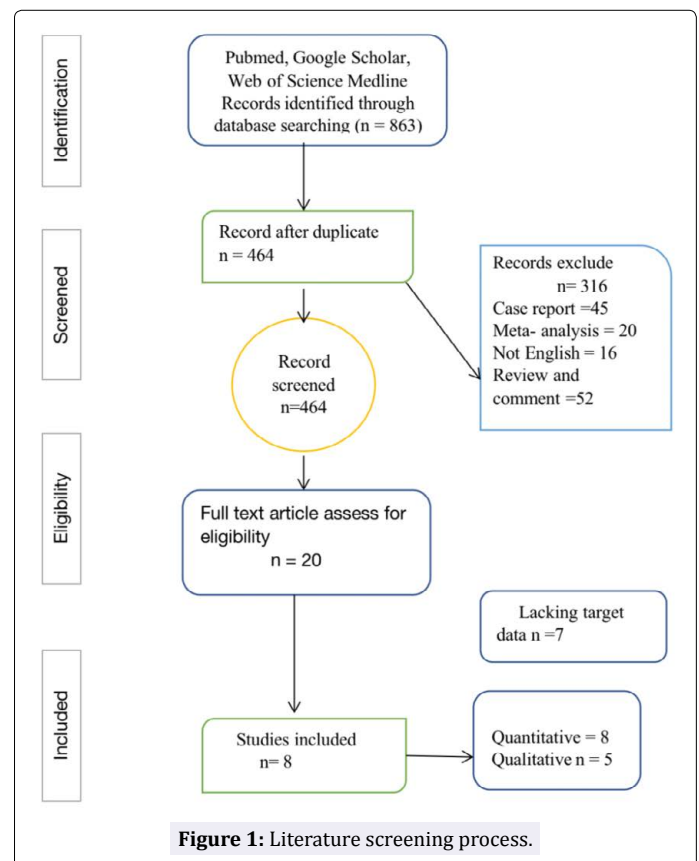
In the present research, we comprehensively perform a review

and meta-analysis to provide evidence for evaluating the effects of both extraperitoneal and transperitoneal route.

## Methods

### Search Strategy

PubMed, Medline, Google Scholar and Web of science data base was searched for articles between the years of 1952 to 2016 comparing both extraperitoneal and transperitoneal route for patient undergoing end colostomy for cancer or other diseases. The following key terms, and their combinations were used: (extraperitoneal, abdominoperineal resection), (intraoperative or transperitoneal), (colostomy or parastomal hernia). The studies and search were evaluated by two reviewers (IAD and ZS) independently based on full text. The results of the search strategy are shown in Figure 1.



## Inclusion Criteria

1) Participants were adult patients undergoing colorectal surgery with end colostomy or abdominoperineal resection. 2) Interventions included extraperitoneal colostomy or transperitoneal colostomy. 3) Outcome measure included parastomal hernia, prolapse, stoma necrosis, infectious and mucutaneous separation.

## Exclusion Criteria

1) Papers which were lacking targeted data. 2) Papers which were not full. 3) Cases, meta-analysis. 4) Non -English papers.

## Data Collection

Search was evaluated by two reviewers independently. Divergences in inclusions were resolved by discussion between reviewers. General characteristic of included studies such as study design, type of intervention (EPC and TPC), author, country and number of patients have shown in table 1. The Colostomy-related complications included were parastomal hernia, prolapse, stenosis, mucutaneous separation, infection and necrosis.

## Statistical Analysis

Analysis was conducted using Review Manager 5.3 (RevMan). The Mantel-Haenszel method was used for the statistical analysis. Dichotomous data were analyzed for odds ratios (OR) and 95% confidence interval were calculated to evaluate the statistical difference between outcomes after extraperitoneal or transperitoneal colostomy. The results were presented by forest plot graph.

## Results

A total of 863 articles were searched from PubMed, Google Scholar, Web of Science, and Medline. 464 articles remained after removal of duplicates. Once screened 464 studies, 20 articles were selected for full-text reading. After full-texts, eight articles were included in qualitative studies shown as in table 2. Out of the qualitative studies, five articles were selected for quantitative studies as shown in table 3. The total number of patients was (n = 514). Out of 514 patients, EPC were (n = 282) and TPC (n = 234). The studies were made up of one randomized controlled trial and seven retrospective studies.

**Table 1:** Characteristics of included studies.

AUTHOR	COUNTRY	STUDY INTERVAL	DESIGN	GROUP	NUMBER OF PATIENT
Heiyang J, et al.[7] 2014	CHINA	2011-2012	RCT	EPC/TPC	18/18
Wang S, et al. [12] 2019	CHINA	2014-2016	RS	EPC	38
Elliot-Smith A, et al. [13] 1961	ENGLAND	1952	RS	EPC	51
Whittaker M, et al. [11] 1976	ENGLAND	1955-1968	RS	EPC/TPC	89/162
Hamada M, et al. [9] 2012	JAPAN	2005-2010	RS	EPC/TPC	22/15
Leroy J, et al. [8] 2012	TAIWAN	1999-2011	RS	EPC/TPC	12/10
Wang J, et al. [14] 2010	CHINA	2007-2009	RS	EPC	22
Hino H, et al. [10] 2017	JAPAN	2007-2015	RS	EPC/TPC	30/29

**Table 2:** Qualitative studies.

AUTHOR	NECROSIS	PROLAPSE	INFECTION	STENOSIS	PARASTOMAL HERNIA
EPC					
Leroy J, et al. [8] 2012	0	0	0	-	0
Wang J, et al. [14] 2010	0	-	0	0	0
Hino H, et al. [10] 2017	-	1(3)	1(3)	-	4(13)
Elliot-Smith A, et al. [13] 1961	-	1	-	2	-
Wang S, et al. [12] 2019	0	0	0	-	0
Heiyang J, et al. [7] 2014	-	1(5.6)	-	1(5.6)	2(11.1)
Whittaker M, et al. [11] 1976	-	2	11	3	8
Hamada M, et al. [9] 2012	2(9.1)	-	4(18.2)	-	1
Total	2/9 (2.1%)	5/238(2.1%)	16/213(7.5%)	6/150(3.3%)	15/231(6.5%)
TPC					
Leroy J, et al. [8] 2012	2	0	1	-	4
Hino H, et al. [10] 2017	-	4(14)	0(0)	-	12(41)
Heiyang J, et al. [7] 2014	-	0	-	0	0
Hamada M, et al. [9] 2012	0	-	1(6.6)	1	5
Whittaker M, et al. [11] 1976	-	10	23	6	28
Total	2/25(8%)	14/219(6.40%)	25/216(11.5%)	6/180(3.3%)	49/234(20.9%)

**Table 3:** Quantitative studies.

Authors	Infection	Prolapse	Mucocutaneous separation	Parastomal hernia	Age
EPC/TPC					
Heiyang J, et al. [7] 2014	-	1/0	-	2/0	59.7±14.4/61.4±11.4
Hamada M, et al. [9] 2012	4/1	-	2/6	1/5	67±10/68±12
Whittaker M, et al. [11] 1976	11/23	2/10	7/17	8/28	-
Leroy J, et al. [8] 2012	0/1	0/0	-	0/4	66.6/75
Hino H, et al. [10] 2017	1/0	1/4	0/1	4/12	77/71

**Parastomal Hernia**

Five studies [7-11], reported a total of 64 patients (15 patients with extraperitoneal colostomy and 49 with transperitoneal colostomy). The parastomal hernia rate was significantly lower in the extraperitoneal group [15 of 231 (6.3%)] compared with the transperitoneal group [(49 of 234 (20.9%); Odds ratio = 0.36 (95% CI, 0.20-0.65); I<sup>2</sup> = 40%; p = 0.0008)]. The detailed results of meta-analysis are given in figure 2.

**Infection**

Four studies [8-11], reported a total 41 patients (16 patients with extraperitoneal colostomy and 25 with transperitoneal colostomy). There was no significant difference in infection rate between extraperitoneal route group [15 of 213 (7.5%)] and transperitoneal routes group [25 of 216(11.5%); Odds ratio = 0.99 (95% CI, 0.31-0.3); I<sup>2</sup> = 0%; p = 0.97)]. The detailed results of meta-analysis are given in figure 3.

**Mucutaneous Separation**

Three studies [9-11], collected 33 patients (9 patients with extraperitoneal colostomy and 24 patients with transperitoneal colostomy). There was no significant difference between extraperitoneal group [9 of 141 (6.4%)] compared with the transperitoneal group [24 of 206 (11.6%); Odds ratio = 0.50 (95% CI, 0.23-1.09); I<sup>2</sup> = 19%; p = 0.08)]. The detailed results of meta-analysis are given in figure 4.

**Prolapse**

Four studies [7-11], collected 19 patients (five patients with extraperitoneal colostomy and 14 patients with transperitoneal colostomy). There was no statistical difference between extraperitoneal group [5 of 238 (2.1%)] compared with the transperitoneal group [14 of 219(6.4%); Odd ratio = 0.42 (95% Ci, 0.14-1.25); I<sup>2</sup> = 0%; p = 0.12)]. The detailed results of meta-analysis are given in figure 5.

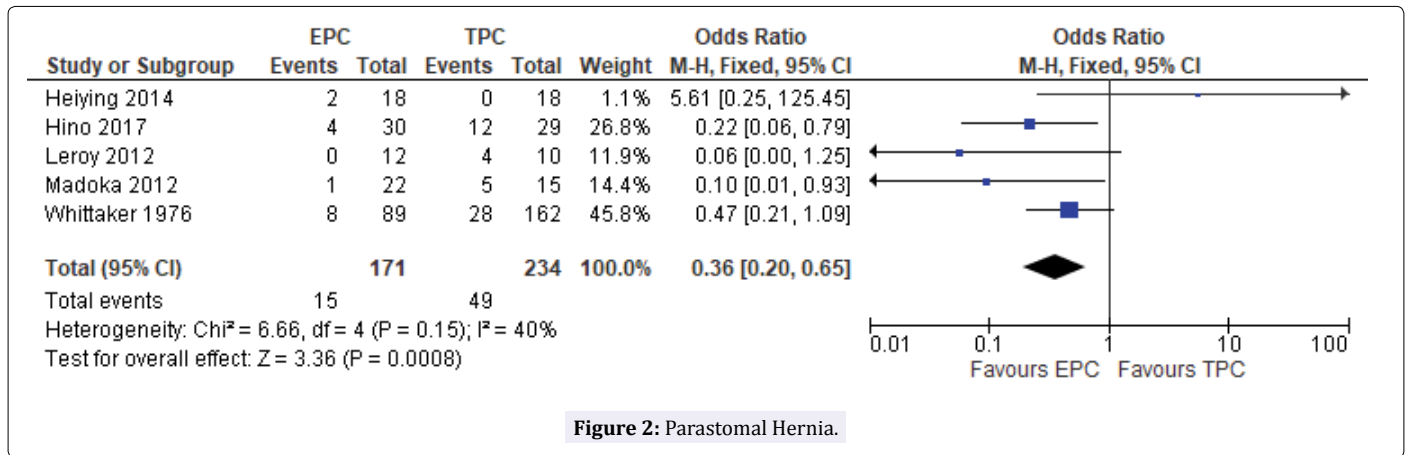


Figure 2: Parastomal Hernia.

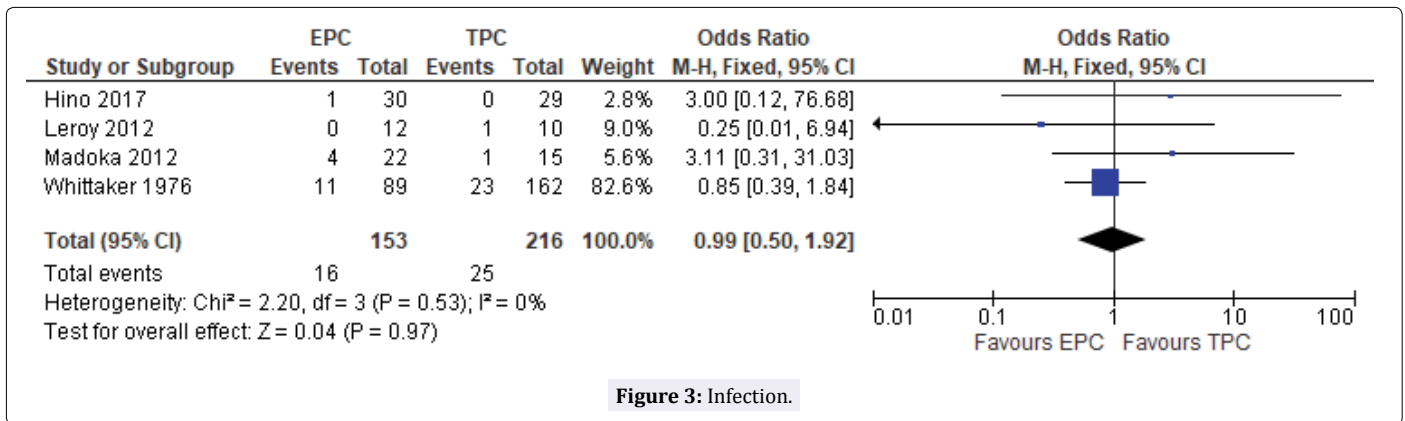


Figure 3: Infection.

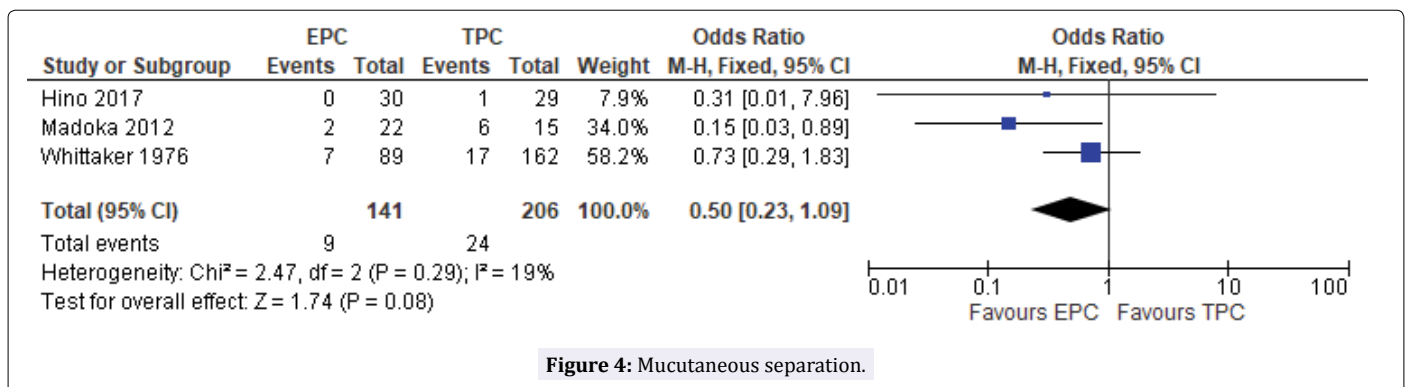


Figure 4: Mucutaneous separation.

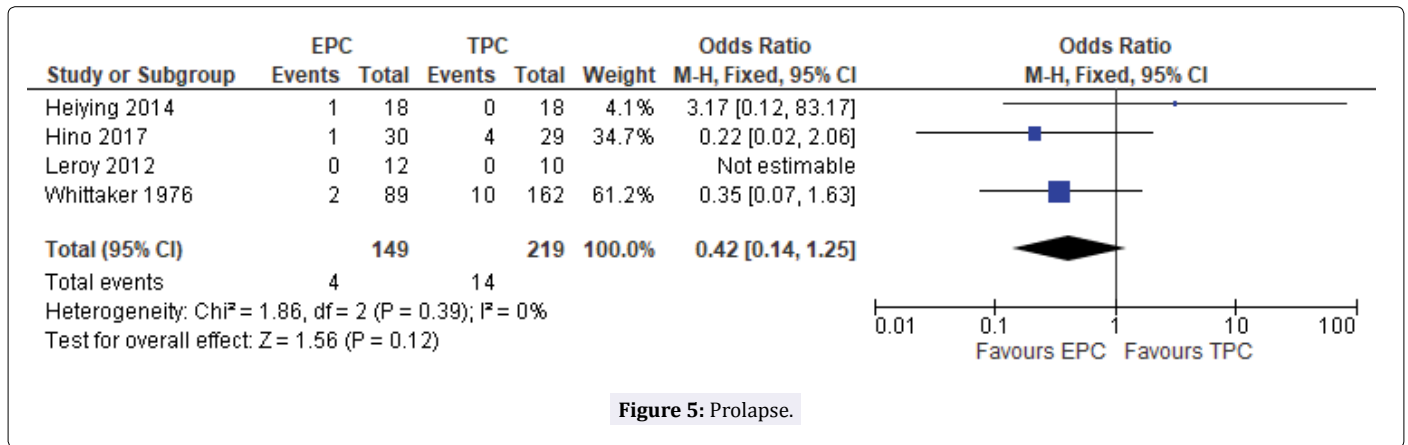


Figure 5: Prolapse.

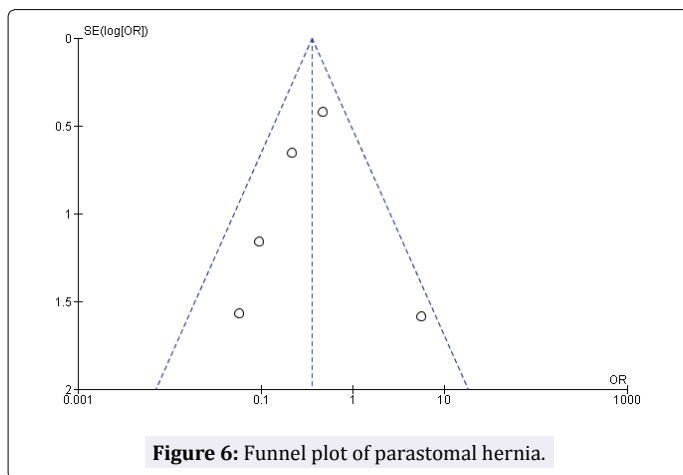


Figure 6: Funnel plot of parastomal hernia.

**Publication Bias**

Because all studies laid in the 95% CI limits, no evidence of publication bias was noted. Egger test was performed to provide statistical evidence regarding funnel plot symmetry. Results still did not reveal any evidence of bias on parastomal hernia (Odds ratio = 0.36 (95% CI, 0.20–0.65); I<sup>2</sup> = 40%; p = 0.0008).

**Discussion**

Post-operative colostomy complications include hernia, prolapse, and obstruction, with parastomal hernia being the most common one. Though most of the parastomal hernias can be managed conservatively, when surgical intervention is needed, the results are poor. And prevention is in no doubt the best management strategy. To avoid a parastomal hernia, colostomy creation via an extraperitoneal route has been attempted, and previous studies reveal promising results. Other systematic also showed the assessment of the published evidence available in the role of the extraperitoneal route in the prevention of postoperative colostomy-related complications [15].

Parastomal hernia remains a frequent complication after stoma formation, occurring in 3 to 39% of all end's colostomies [16,17]. Traditionally, a colostomy is constructed transperitoneal. To reduce the incidence of parastomal hernias, colostomy through the extraperitoneal route has been used as an alternative technique. Recent publications suggest beneficial effects of this extraperitoneal stoma formation; however, these studies are incomplete, and unclear about their methods.

In our study, we discover our using extraperitoneal route is effective in reducing the incident of parastomal hernia compared to transperitoneal route, and at the same time, our analysis shows

a statistically significant difference in extraperitoneal route [Odds ratio = 0.36 (95% CI, 0.20–0.65); I<sup>2</sup> = 40%; p = 0.0008]. The main reason for the incidence of the parastomal hernia is the junction between the colons and the abdominal wall is not dense enough [18]. There was no statistical significance difference for necrosis, prolapse, and mucutaneous separation between the EPC group and the TPC group, although the qualitative study favored the EPC group. Concerning other post-operative colostomy complications, Hamada M, et al. [9] reported an 18.2% infection rate in the extraperitoneal route compared with 6.6% in the transperitoneal route and necrosis of the stoma was 9.1% higher than the transperitoneal route.

When the stoma is created there is a weakness within the abdominal muscle. But extraperitoneal colostomy will adjust with the pressure and tension compared to transperitoneal colostomy where the pressure will be intense through all the abdominal layers. Since Goligher [19] reported extraperitoneal colostomy in 1958, surgeons usually believed extraperitoneal colostomy was better than intraperitoneal colostomy concerning postoperative complications. However, few studies were comparing the advantages, and disadvantages between extraperitoneal and intraperitoneal colostomy. An extraperitoneal colostomy may be associated with the increasing length of operative time and complications. There are different opinions in the literature regarding the clinical significance of the extraperitoneal route. Some author considered it “had little impact on the incidence of parastomal hernia” [20], while others claimed that it was considered “the method of choice for patients needing a permanent iliac colostomy” [21] However, it was later considered “a good option for patients needing a permanent iliac colostomy” [22], but “much preferred because of fewer complications related to parastomal herniation, prolapse, retraction, and internal herniation” [22]. As of now, the adoption of the extraperitoneal versus intraperitoneal route for colostomy construction is based on the preference of the surgeon. Conflicting opinions exist even in surgical textbooks. There are few in the literature examining the difference between the two techniques and subject to the drawback of a low level of evidence. Thus, a significant gap in the literature remains. The conventional way of a transperitoneal route has comparatively high incidents of long-term complications, such as parastomal hernias [23], stoma prolapses, and stoma retraction. It is reported that half of the patients who received transperitoneal colostomy may have some degree of parastomal hernia [23]. Due to the tension of retracting, the stoma on the abdominal walls may be extended, creating more space between the stomas and the stump sigmoid end which can also contain small bowel tissues through the incision on the peritoneum. Prophylactic stoma mesh is now also widely accepted as the solution to parastomal hernia repair by western surgeons [12]. The main purpose of this technique is to use the stoma mesh to overlay the fascial defects to decrease the incidents

of parastomal hernia. However, current research revealed that prophylactic stoma mesh could not prevent parastomal hernias as we expected [12].

The critical limitation of our study is a large amount of retrospective studies and a small number of randomized control trials. A prospective randomized control trial is needed to further identify the effect of the extraperitoneal route in the prevention of stoma-related complications.

In summary, based on the present confirmation, colostomy creation via an extraperitoneal route appears to be an effective way to reduce the incidence rate of parastomal hernia when compared to the transperitoneal route colostomy. Therefore, Prospective RCT is warranted to enhance the role of the extraperitoneal route in the prevention of parastomal hernia.

### Author Contributions

IAD and ZS are responsible for the concept and design of the work, IAD, WXG, XXF, QJG and DSC are responsible for acquisition, analysis and interpretation of the data, DSC is responsible for interpretation of the data and all authors reviewed the manuscript.

### Competing Interest

None.

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