**A Systematic Review of the effect of Gastric Pouch and/or Gastro-Jejunostomy (Stoma) size on weight loss outcomes with Roux-en-Y Gastric Bypass**

**Abstract:**

**Background:** The effect of the gastric pouch or Gastro-Jejunostomy (GJ or stoma) size on weight loss outcomes after Roux-en-Y Gastric Bypass (RYGB) is unclear with studies reporting conflicting results. The purpose of this systematic review was to determine the impact of the gastric pouch or stoma size on weight loss outcomes with RYGB.

**Methods:** An online search of PubMed was carried out to identify all articles evaluating the effect of the gastric pouch and/or gastric stoma size at the time of surgery on outcomes associated with RYGB. Quality and heterogeneity of data precluded a meta-analysis. So a systematic review was performed without a meta-analysis.

**Results:** This review found a total of 14 studies (two of which were randomised) evaluating the effect of pouch sizes on weight loss outcomes after RYGB. Nine of these studies did not find any significant association between pouch size and weight loss outcomes whereas five studies found larger pouches to be associated with poorer weight loss outcomes. No study found larger pouches to be associated with better weight loss outcomes.

Out of the 10 studies (one of which was randomised) that evaluated the effect of stoma size on weight loss outcomes after RYGB, six studies did not show any significant effect of stoma size on weight loss outcomes and four found larger stoma sizes to be associated with significantly poorer weight loss outcomes. No study found larger stoma to be associated with better weight loss outcomes.

**Conclusions:** This review finds that a larger pouch or stoma size may be associated with adverse weight loss outcomes but the quality of data does not allow us to precisely determine optimum pouch or stoma size with RYGB. There is a need for more randomised data comparing long term weight loss outcomes with pouches or stoma of different sizes.

**Key Words:** Roux-en-Y Gastric Bypass, Gastric Bypass, Pouch, Stoma, Gastro-Jejunostomy size, Weight Loss

**Introduction:**

Roux-en-Y Gastric Bypass (RYGB) is the second commonest bariatric procedure worldwide [1] as well as the longest-serving procedure [2]. It has traditionally been described as a combined restrictive and malabsorptive procedure [3]. It is only recently becoming apparent that malabsorption makes a very small contribution to the short-term weight loss outcomes after this procedure [4] and that its effect on hunger and satiety mediated through yet incompletely understood mechanisms may play a more significant role [5].

There is little doubt that RYGB results in significantly decreased calorie intake that persists in the long term, but the precise reason for that is currently unknown. There are studies showing that the size of the gastric pouch [6] and the Gastro-Jejunostomy (GJ) [7], popularly known as stoma, are important determinants of weight loss outcomes after RYGB. But there are also studies that have not found any correlation between the pouch or the stoma size and weight loss outcomes [8-10].

It is important to understand the influence of the pouch and/or stoma size on weight loss outcomes after RYGB because of its direct relationship with the surgical techniques involved. This knowledge may also enable us to develop less invasive therapeutic options for patients suffering from morbid obesity in the future. It may also influence treatment strategies for patients with an unsatisfactory therapeutic response after RYGB found to have a dilated pouch and/or stoma.

There is as yet no systematic review in scientific literature evaluating the importance of pouch and stoma size at the time of surgery on weight loss after RYGB. The purpose of this systematic review was to understand the influence of pouch and stoma size at the time of surgery on weight loss outcomes with Proximal RYGB in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

**Methods:**

An online search of PubMed was carried out using key-words like, ‘bariatric surgery', ‘gastric bypass, ‘Roux en Y Gastric Bypass’, ‘restriction’, ‘pouch’, ‘stoma’, ‘gastroenterostomy’, ‘gastrojejunostomy’, and ‘weight loss’ to identify all articles evaluating the effect of gastric pouch and/or gastric stoma size at the time of surgery on outcomes associated with RYGB. Articles were also identified from references of relevant articles. Last of these searches were carried out on 10th May 2019.

We excluded non-human studies, case reports, non-English language articles, and review articles with no new data. Studies on banded bypass were excluded as were those on loop gastric bypass and those that did not have sufficient data [10]. No time filter was used. A total of 24 articles were included. Figure 1 gives a PRISMA flow chart for article selection. Since the data, with wide variations in baseline population (only two studies evaluating pouch sizes were randomised and one study evaluating stoma size was randomised), surgical technique, and outcomes studied, does not lend itself to a meta-analysis, we performed a systematic review without a meta-analysis.

No Institutional Review Board Approval or Consent was deemed necessary for this review.

**Results:**

**Studies examining the effect of Pouch Size on Weight Loss Outcomes**

A total of 14 studies [6-8, 10-20] evaluated the effect of pouch size at the time of surgery on weight loss outcomes after RYGB. Both of the randomised studies [13,18] found larger pouches to be associated with significantly lower weight loss and poorer diabetes outcomes.

Table 1 [8, 10, 12, 14-17, 19-20] details important characteristics of all the nine studies that did not find any significant association between pouch size and weight loss outcomes. It is worth noting that a couple of these studies (12,14) did report a non-significant trend towards poorer weight loss outcomes with a larger pouch. In each of these studies, gastric pouches in all of the patients were constructed using the same standardised technique at the outset. All of these were retrospective studies.

Table 2 [6-7, 11, 13, 18] provides important characteristics of five studies that found larger pouches to be associated with poorer weight loss outcomes. Both the randomised studies, which were also the studies evaluating pouches constructed differently from the outset [13,18] found larger pouches to be associated with significantly lower weight loss and poorer diabetes outcomes. Pouches shown to be associated with poorer weight loss outcomes were ≥ 25.0 ml in each of the studies in Table 2.

Overall, this review found a total of 14 studies evaluating the effect of pouch sizes on weight loss outcomes after RYGB. There were only two studies where authors [13, 18] had constructed pouches of different sizes at the outset. In all of the remaining 12 studies, pouches were constructed using a similar technique. The same two studies [13, 18] were also the only randomised studies on this topic. Both of these studies found larger pouches to be associated with poorer weight loss and metabolic outcomes. None of the 14 studies showed better weight loss outcomes with larger pouches. One study [8] suggested an increased marginal ulcer rate in patients with larger pouches.

**Studies examining the effect of Stoma Size on Weight Loss Outcomes**

A total of 10 studies [7, 15, 21-28] evaluated the effect of the size of the GJ at the time of surgery on weight loss outcomes.

Table 3 [15, 23-24,26-28] lists salient characteristics of six studies that did not show any significant effect of stoma size on weight loss outcomes. Four of these studies compared outcomes with circular staplers of 21 mm (outside circumference 66 mm) and 25 mm (outside circumference 78.5 mm) diameter. Only one study [15] was with linear stapled anastomosis and only one randomised study [23]. Some authors [24, 27] found 21 mm stomas to be associated with higher stenosis rates.

Table 4 [7, 21-22, 25] details important characteristics of four studies that found a larger stoma size to be associated with poorer weight loss outcomes. Two of these studies [21-22] are from the same group of authors with potential for the overlapping population. Out of these four studies, only one [25] had patients with different stoma sizes to start off with.

Overall, this review found 10 studies (one randomised) evaluating the effect of different stoma sizes on weight loss outcomes after RYGB. None of these studies found larger stomas to be associated with better weight loss outcomes. In the context of the circular stapler, there is no difference in weight loss outcomes between 25 mm and 21 mm staplers with a higher stenosis rate with 21 mm stapler. There is a scarcity of data with different length of linear staplers.

**Discussion:**

This review shows that very few studies in the scientific literature have examined the effect of pouch sizes [13, 18] or stoma sizes [25] on weight loss outcomes after RYGB where they were created differently at the time of surgery. Other studies have simply presented a correlation between the pouch and/or stoma sizes with weight loss outcomes amongst patients whose pouches were performed using the same technique. Any difference in pouch/ stoma sizes in these studies is likely to be small and may also be due to pouch/ stoma enlarging due to factors such as patients’ eating habits. This means that the association of larger pouches/ stoma with poorer weight loss outcomes cannot be implied to automatically indicate causation. The pouches can further enlarge with time due to a number of technical and patient related factors. For example, it is possible that a longer, narrower pouch with a wide stoma would be less like to dilate over time than a broader pouch with a narrower stoma. Patients’ eating behaviour may also have an effect. It is further possible that pouch emptying rate is a more important determinant of weight loss outcomes than the pouch size itself, something this review does not examine.

Another important finding of this review is that there is no study in the scientific literature which has shown better weight loss outcomes with larger pouches/ stoma. We know from other data that larger pouches may be associated with higher marginal ulcer rates [8] and larger stoma may be associated with more dumping [27, 29]. At the same time, too short a pouch may make the operation technically more difficult especially in those with short mesentery; and a very narrow stoma (such as one created with 21 mm diameter circular stapler) is associated with significantly higher stenosis rates [30]. It would, therefore, be useful to determine the optimum pouch and/or stoma size that allows for the performance of safe operation with a low early and late morbidity and also does not compromise the long-term weight loss outcomes.

Most surgeons these days use a stapler (circular or linear) to perform the gastro-jejunostomy. This review shows (Table 3) that 25 mm circular stapler performed gastro-jejunostomy is not associated with significantly poorer weight loss outcomes in comparison with 21 mm circular stapled anastomoses and is generally associated with lower stenosis rates. This, therefore, follows that the anastomosis diameter does not need to be any narrower than 25 mm. Though it is relatively easy to determine the precise stoma size when a circular stapler is used, it can only be guessed when the anastomosis is constructed using a linear stapler because the stapled section forms only a part of the stoma.

At the same time, the size of the stoma with a linear stapler would probably be at least as big as the size of the closed stapler it needs to accommodate. We can, therefore, assume that irrespective of the length of the stapler used, a linear stapled anastomosis would be larger than a 25-mm circular stapled anastomosis [27]. There is only study in the scientific literature [25] examining two different lengths of linear staplers and this study found anastomoses with 45 mm linear stapler associated with significantly poorer weight loss in comparison to those performed using 15 mm linear staplers. It is worth noting here that the anastomoses with 15 mm stapler are not likely to be a third in size compared to 45 mm stapler, as the anterior half of the anastomosis is determined by the size of the stapler entry holes and is likely to be similar in both groups. Sima et al [27] estimated that even with the use of a 30-mm linear stapler, the anastomosis is likely to be significantly larger than that with a 25-mm circular stapler.

The functional stoma size will be further determined by the size of the pouch above and that of the jejunum below and in case of a banded procedure, by the size of the band placed above the anastomosis. All these factors make determining an optimum stoma size with a stoma constructed using linear staplers somewhat difficult. More studies are though needed to examine various lengths of linear staplers.

When it comes to pouch sizes, this review suggests that larger pouches do not offer any advantages in terms of weight loss outcomes with RYGB and may even be associated with higher marginal ulcer rates. The quality of the data does not, however, allow us to determine any cut-off value for pouch size that would deliver optimum results though the pouches shown to be associated with poorer weight loss outcomes tended to be larger (Table 2). This review also highlights variations in techniques used for measurement of pouch sizes in the published literature.

This review has several weaknesses. Wide variation in the techniques used for the performance of RYGB and measurements of the pouch/stoma; and lack of randomised studies (there were only two randomised studies evaluating the effect of pouch size and one randomised study evaluating the effect of stoma size) means that a meta-analysis of existing scientific data is not possible. This makes it very difficult to draw robust conclusions from this review. However, this is the first systematic attempt to analyse published literature on this difficult topic. Though the main finding of this review is that quality of published data in scientific literature is too poor to allow for any meaningful conclusion, it did observe that not a single study in published literature has till date found larger pouches/stoma to be associated with better weight loss outcomes after RYGB.

This review found that larger pouches tend to be associated with poorer weight loss outcomes after RYGB. It further identifies that GJ narrower than 25 mm diameter does not result in superior outcomes. At the same time, poor quality of studies and difficulties in precisely measuring the size of the pouch and the stoma mean that it is difficult to draw robust conclusions from available data. Moreover, there is a relative paucity of studies examining stoma size with various lengths of linear staplers.

**Conclusion:**

This systematic review highlights a lack of high quality randomised studies evaluating the effect of different pouch or stoma on weight loss outcomes with RYGB. The review found that larger pouches tended to be associated with worse weight loss outcomes. But, at the same time, it highlights the difficulties in precisely measuring the size of a functional pouch as authors have used a number of different techniques in the published scientific literature.

When it comes to the stoma, 21 mm diameter does not offer better weight loss outcomes in comparison to 25-mm diameter but may be associated with higher stenosis rates. The review further highlights the difficulty in precisely measuring the stoma size when a linear stapler is used and emphasises the need for more studies evaluating different lengths of linear staplers.

**Conflict of Interest Statement:** Prof. Mahawar has been paid honoraria by Medtronic, Gore, Olympus, and NHS for educational activities, outside the submitted work. Mr. Sharples and Dr. Graham have no conflict of interest or financial ties to disclose.

**Statement of Human and Animal Rights:** Not Applicable

**Statement of Informed Consent:** Not Applicable

**Author Contribution:**

Author 1 conceived the topic, performed the review, and wrote most of the manuscript. Author 1 and 3 independently searched for all relevant articles. All authors participated in discussions on the topic and contributed to manuscript writing. All authors have seen the final version and approve of it.

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**Abbreviations:**

**RYGB:** Roux –en- Y Gastric Bypass

**GJ:** Gastro-jejunostomy

**PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses

**AL:** Alimentary Limb

**BPL:** Bilio-Pancreatic Limb

**EWL:** Excess Weight Loss

**EBMIL:** Excess Body Mass Index Loss

**TWL:** Total Weight Loss

**GJA:** Gastro-jejunal Anastomosis

**BMI:** Body Mass Index

**Legend to Figure 1: PRISMA Flow Chart for Article Selection**

**Legend to Table 1:** Studies that did not find any association between Pouch size and Weight Loss outcomes after Roux-en-Y Gastric Bypass

**Legend Table 2:** Studies that found larger Pouch size to be associated with poorer Weight Loss outcomes after Roux-en-Y Gastric Bypass

**Legend to Table 3:** Studies that found no association between Stoma size and Weight Loss outcomes after Roux-en-Y Gastric Bypass

**Legend to Table 4:** Studies that found smaller Stoma size to be associated with better Weight Loss outcomes after Roux-en-Y Gastric Bypass