BILIOPANCREATIC LOOP LENGTH IN ONE-ANASTOMOSIS GASTRIC BYPASS: A LITERATURE REVIEW

DOI: 10.35805/BSK2025IV011
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recieved: 05.11.2025
accepted: 20.11.2025

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Conflict of interest:
The authors declare no potential conflict of interest requiring disclosure in this article.

Keywords:
morbid obesity, single-anastomosis gastric bypass, one-anastomosis gastric bypass, mini-gastric bypass, single-anastomosis gastro-ileal bypass, biliopancreatic loop length, common limb length, total small bowel length, excessive weight loss.

Abstract

One-anastomosis gastric bypass is currently a common procedure in bariatric and metabolic surgery. This procedure, based on a single-loop gastroenteric anastomosis (biliopancreatic loop) with a long, narrow stomach, has a mixed mechanism of action (restriction and malabsorption). However, the biliopancreatic loop, and in particular its length, is considered responsible for the degree of malabsorption, but the most appropriate or "optimal" biliopancreatic loop length remains a subject of debate. This literature review examines the relationship between biliopancreatic loop length, selected using various methods, and postoperative weight loss and nutritional deficiencies.

Introduction

Obesity is one of the most common non-infectious diseases worldwide. According to the World Obesity Federation, by 2035, more than 4 billion people worldwide will be overweight (BMI over 25 kg/m2), and the prevalence of obesity will rise to 24%, affecting nearly 2 billion adults, children, and adolescents. Although obesity prevalence in Asia is relatively low, it is projected to increase sharply between 2020 and 2035: from 4% to 10% among men and from 8% to 16% among women[1,2].

Obesity surgery, as a distinct surgical field, first emerged in the 1950s and 1960s, when *Kremen A.J. et al.* reported in 1954 the use of an anastomosis between the proximal jejunum and the distal ileum, bypassing most of the small intestine, to treat severe forms of dyslipidemia. However, this type of intervention was associated with severe metabolic consequences, with most patients suffering from severe diarrhea and dehydration[3-5].

Gastric bypass with a single anastomosis was first proposed by *Mason E.* in 1967. He proposed a short, wide, horizontal «small stomach». However, due to the mechanism causing bile reflux, this concept was abandoned[6,7].

By the 1990s, the «laparoscopic revolution in surgery» led to the rapid growth and widespread use of minimally invasive bariatric surgeries. In 1997, *Rutledge R.* introduced his version of one-anastomosis gastric bypass (OAGB), calling it «mini-gastric bypass»[8,9].

When considering bypass procedures for the treatment of morbid obesity and metabolic syndrome, surgeons often face the challenge of choosing the optimal biliopancreatic loop (BPL) length. With the widespread adoption of OAGB as a

primary surgical treatment for obesity, many bariatric surgeons worldwide utilize various modifications, particularly those with varying BPL. Currently, there are no standard guidelines for the optimal BPL for OAGB. According to a review, BPL range from 120 cm to longer ones, up to 300 cm.

The main question here is: «Should we use a standard fixed length or optimize the length of the biliopancreatic loop for each patient?»

Materials and methods

Study Design and Search strategy. We conducted this review following the MOOSE guidelines for meta-analysis of observational studies. Our literature search covered PubMed, Scopus, Web of Science, Embase databases from their inception through August 2025. We used these search terms: «morbid obesity», «single-anastomosis gastric bypass», «one-anastomosis gastric bypass», «biliopancreatic loop length», «common limb length», «total small bowel length», «excessive weight loss», «mini-gastric bypass» and «single-anastomosis gastro-ileal bypass» in various combinations. We also manually searched reference lists of retrieved articles to identify additional relevant studies.

Eligibity Criteria. We included studies that: examined relationship between biliopancreatic loop length in one-anastomosis gastric bypass and various metabolic outcomes; examined one-anastomosis gastric bypass outcomes adjusted for fixed biliopancreatic loop length, BMI, BP/TSBL ratio, and fixed common channel length; were published in English with full text; and had a clear methodology and outcomes related to atherosclerosis. We excluded case reports, conference abstracts, letters, commentaries, and methodologically unclear studies addressing the treatment of morbid obesity using one-anastomosis gastric bypass.

Data Extraction and Quality Assessment. Data were extracted using a standardized form. We collected information on authors, publication year, study design, sample size, population characteristics, outcome assessment methods for single-anastomosis gastric bypass in patients with morbid obesity, main findings, and statistical approaches.

Data Synthesis and Analysis. We performed a qualitative synthesis and analysis, categorizing the search results according to the following criteria: 1) Outcomes of one-anastomosis gastric bypass with a fixed biliopancreatic loop length; 2) Outcomes of one-anastomosis gastric bypass with a biliopancreatic loop length adjusted for BMI; 3) Outcomes of one-anastomosis gastric bypass with a biliopancreatic loop length adjusted for the total small bowel length; 4) Outcomes of one-anastomosis gastric bypass with a fixed common loop length.

Results

Fixed Biliopancreatic Limb Length in One-Anastomosis Gastric Bypass

One-anastomosis gastric bypass (OAGB), also referred to as mini-gastric bypass, has emerged as a relatively recent option in bariatric and metabolic surgery.

The first description of this procedure was provided by *Rutledge R.*in 1997, who created a biliopancreatic limb (BPL) of approximately 150–200 cm distal to the ligament of Treitz[8,10]. According to his early reports, this limb length offered a balance of safety and efficacy. Similar parameters were later applied by *Wang W.*in 2005 in his initial series of patients[11].

Subsequent studies reported consistent findings. For instance, a meta-analysis by *Solouki et al. (2018)* demonstrated that OAGB with a fixed BPL of 150–200 cm was effective in achieving weight reduction and improving obesity-related comorbidities, while maintaining an acceptable complication profile compared with Roux-en-Y gastric bypass (RYGB)[12].

Neuberg M. et al. (2019) published a retrospective 5-year follow-up of 163 patients undergoing OAGB with a 150 cm BPL. Their analysis confirmed the safety and effectiveness of the procedure and noted improvements in patient-reported quality of life[13]. Similarly, *Lessing Y. et al. (2017)* from the USA employed a 200 cm BPL in both primary and revisional OAGB and concluded that the approach was equally safe and beneficial in both contexts[14].

Sam M.A. et al. (2022) studied the effect of OAGB on liver function tests in their patients[15]. This study included 405 patients: patients who underwent

OAGB with a BPLL of 150 cm (n=171) and patients with OAGB with a BPLL of 200 cm (n=234). In the OAGB group with a BPLL of 200 cm, a significant improvement in GGT levels was noted. In the OAGB group with a BPLL of 150 cm, a significant improvement in GGT and ALT levels was noted, and a lower bilirubin level was observed after 1 year. In both groups, a deterioration in alkaline phosphatase and albumin was observed after 1 and 2 years after surgery. This study demonstrates the safety of OAGB in relation to liver function tests, with no significant difference between a BPLL of 150 cm and 200 cm.

The increase in the number of OAGB surgeries has led to increased concern about protein-calorie malnutrition in patients with BPLL greater than 200 cm. The influence of BPLL on the severe consequences of malabsorption syndrome, including severe protein-calorie malnutrition, requires ongoing drug correction, up to revision surgery after OAGB. *Khalaj A. et al. (2019)* reported on 7 patients out of 189 who developed severe protein-calorie malnutrition[16]. According to *Abu-Abeid A. et al. (2022)*, 0.63% (9 patients out of 1425) developed severe protein-calorie malnutrition, for which these patients underwent repeat surgeries[17]. *Elgeidie A. et al. (2020)* reported 8 patients with severe protein-calorie malnutrition, of whom 2 died before reoperation and 1 patient died after reoperation[18].

On this topic, *Mahawar K. et al. (2018)* published an article in which 118 surgeons from 30 countries were surveyed[19]. A total of 47,364 were performed OAGB surgeries. Overall, 0.37% (138/36,952) of patients required revision surgery for malnutrition. The highest percentage of 0.51% (120/23,277) was recorded in patients with a BPLLlonger than 200 cm, and the lowest rate of 0% was observed with a BPLL of 150 cm. In this regard, many authors adhere to a «fixed»BPLLfor 150 cm OAGB. A group of authors *Ahuja A. et al. (2018)* also came to this conclusion[20].

Balamurugan G. et al. (2025) reported that a longer BPLL (>200 cm) is associated with a higher risk of developing malabsorptive syndrome, while a shorter BPLL (150-200 cm) has potential benefits by reducing the risk of developing malabsorptive syndrome[21]. According to studies by other authors[15,22-28], OAGB with a BPLL of 150 cm showed effective weight loss, resolution of comorbidities, and improved quality of life without nutritional deficiencies with a very low level of protein-calorie malnutrition. Patients who used a BPLL of 200 cm also showed effective weight loss and resolution of comorbidities, however, there were a higher number of patients with nutritional deficiencies (e.g., hypoalbuminemia, deficiency of B vitamins, iron, and ferritin), even in superobese patients (BMI greater than 50 kg/m^2). However, it should be noted that the most commonly used BPLL in OAGB remains 200 cm[29-35] (Table 1).

Table 1. Fixed Biliopancreatic Limb Length in One-Anastomosis Gastric Bypass

Author	Year	Number of patients, n	Follow-up, month	BMI before surgery, kg/m^2	BPLL, cm	%EWL
R. Rutledge[8]	2001	1274	24	47.0	200	77
R. Rutledge[10]	2005	2410	38.7	46.0±7.0	200	80
W.Wang[11]	2005	423	36	44.2±7.0	200	70.5
K. Kular[33]	2014	1054	72	43.2±7.4	200	85
G. Jammu[34]	2016	473	20-87	56.5	200	92.2
S. Seetharamaiah[35]	2017	101	12	44.3	150-180	66.87
Y. Lessing[14]	2017	407	12	41.7±5.77	200	85.1
M. Jain[32]	2022	101	12	39.73±4.75 51.92±6.05	150 180	67.24±11.38 64.47±10.03
F. Pizza[27]	2022	60 60	24	44.93±7.56	150 200	60.7±16.1 61.2±12.1

T. Bertrand[24]	2022	392 392	32.4- 44.87	43.0±3.6 42.6±3.6	150 200	75.5±24.02 76.8±21.6
M.A. Sam[15]	2022	171 234	36	49.0±8.14	150 200	75.02±21.35 76.46±20.1
B. Gricks[28]	2022	325	12	43.3	150	74,2

The biliopancreatic limb length in OAGB tailored in relation to the BMI

Adaptation of biliopancreatic loop length based on BMI in OAGB was first described in a 2008 study by *Lee W.J. et al*.[36]According to the author, a fixed biliopancreatic loop length of 200 cm is not always appropriate for patients with a low or extremely high BMI. For a BMI of 35 kg/m², he used a BPLL of 150 cm, increasing the loop length by 10 cm with each BMI point. As a result, the average loop length was 150 cm, 250 cm, and 350 cm for patients with a BMI of less than 40 kg/m², 40-50 kg/m², and more than 50 kg/m², respectively. *Lee W.J.* published results from 644 patients. Weight loss and resolution of obesity-related comorbidities were satisfactory. However, patients with low BMI had more severe anemia than those in both groups. Similar results were obtained in the studies of *Noun R. et al.*[37]

A multicenter experience of Italian surgeons from 974 cases under the supervision of *Musella M. et al. (2014)*, where the BPLL in OAGB was adapted according to *Lee W.J.,* showed that in addition to high %EWL rates (after 5 years – 77.0±5.1) and resolution of concomitant diseases such as type 2 diabetes mellitus and arterial hypertension, 5.3% (44/818) of patients developed iron deficiency anemia, and 2 patients required reoperation due to excessive weight loss (EWL> 100%)[38]. *Taha O. et al. (2017)* analyzed the results of OAGB in 1520 patients with adaptation of the BPLL in the range from 150 cm to 300 cm[39]. The mean %EWL over 6 years was 80.2±5.9%, with 3.1% (47/1520) of patients developing iron deficiency anemia, and 3 patients requiring reoperation due to excessive weight loss.

Kermansaravi M. et al. (2020) encountered cases of severe weight loss and hypoalbuminemia when using a constant standardized BPLL of 200 cm[40]. In this regard, the last 653 patients underwent adaptation of the BPL by adjusting the BPLL depending on the patient's BMI and age. For BMI of 35-39 kg/m², 40-50 kg/m² and more than 50 kg/m², they used a BPLL of 180 cm, 200 cm and 220 cm, respectively, with a decrease in length by 10 cm every 5 years after the age of 45 years. The %EWL indicators after 1 year were 96±32.58, 84.63±18.1 and 68.37±12.34, respectively (Table 2).

Table 2.
The biliopancreatic limb length in OAGB tailored in relation to the BMI

Author	Year	Number of patients, n	Follow-up, month	BMI before surgery, kg/m²	BPLL, cm	%EWL
W.J.Lee[36]	2008	644	24	<40 40-50 >50	150 250 350	79.1±23.5 73.1±15.6 67.2±12.5
R. Noun[37]	2012	1000	60	42.5±6.3	150+10 cm for each BMI point	68.6±21.9
M. Musella[38]	2014	974	60	48.0±4.58	224,6 ± 23,2	77.0±5.14
O.Taha[39]	2017	1520	36	46.8	150-300	80,2
M.Kermansaravi[40]	2020	653	12	35-39 40-50 >50	180 200 220	96±32.58 84.63±18.1 68.37±12.34
N.Slagter[41]	2021	632	36	<40 40-44.9 45-49.9	150 180 200	83.0 77.0 75.0

Slagter N. et al. (2021) present their results in a study of the optimal length of the BPL in OAGB[41]. In a retrospective single-center cohort study, they optimized the BPLL depending on the initial BMI. All patients (n = 632) were divided into 3 groups: 1) a BPLL of 150 cm in patients with a BMI below 40 kg/m^2; 2) a BPLL of 180 cm in patients with a BMI of 40.0-44.9 kg/m^2, and 3) a BPLL of 200 cm in patients with a BMI of 45-49.9 kg/m^2. One year after surgery, the achieved BMI was significantly higher in the groups with a longer BPL. The 200 cm BPLL group showed greater BMI and excess weight loss compared to the 150 cm and 180 cm BPLL groups, with no significant difference between them. However, %EWL was significantly higher in the shorter groups (89%, 78%, and 73%, respectively). After 3 years, achieved BMI, BMI loss, and excess weight were significantly higher in the groups with longer BPLL. Percentof EWL was significantly higher in the 150 cm BPLL group compared with the other two groups, with no differences between patients in the 180 and 200 cm BPLL groups. No difference in %TWL was found between the groups. The hypothesis in this study was that a longer BPLL in patients with a higher BMI would result in greater weight loss, so the final BMI in these patients would be similar to that in patients with a lower preoperative BMI. However, the results of this retrospective cohort study do not support this hypothesis. The greater BMI loss in the groups with longer BPLLs appears to be primarily due to a higher preoperative BMI rather than a longer BPLL. A similar effect was observed in the studies of *Barhouch A.S. et al. (2016)* when they investigated predictors of weight loss after Roux-en-Y gastric bypass in 2070 patients[42]. A higher preoperative BMI also resulted in a higher postoperative BMI and a lower % EWL. Furthermore, there were no statistically significant differences in the remission rates of type 2 diabetes or hypertension between the limb length groups. In such cases, using % EWL or % TWL as the outcome when comparing different BMI groups introduces systematic error. Therefore, adjusting the BPLL according to the baseline BMI did not eliminate the differences in BMI 3 years after OAGB, nor did it reveal differences in the resolution of comorbidities. This study highlights the need for further research to identify the optimal method for determining the BPLL in OAGB.

Abu-Abeid A. et al. (2024) conducted a survey to discuss the technical aspects of OAGB among the majority of bariatric surgeons from the Israeli Society for Metabolic and Bariatric Surgery[43]. Most of them agreed that BMI and the frequency of revision surgery were important factors for individualizing the BPLL.

Based on the above data, BPLL can be adjusted based on BMI; however, this does not result in a statistically significant difference in weight loss compared to a fixed BPLL of 150 cm.

The biliopancreatic limb length tailored in relation to the total small bowel length

Measuring the BPLL and the total small bowel length (TSBL) may be of fundamental importance not only for achieving successful weight loss and better metabolic effect, but also for preventing protein-calorie malnutrition and malabsorption syndrome. According to *Teitelbaum E.N. et al. (2013)*, the average TSBLis 506±105 cm (285-845 cm)[44], and according to *Tacchino R.M. et al. (2015)*, this indicator is 690±93.7 cm (350-1049 cm)[45].

Komaei I. et al. (2019) compared the results of 32 patients with a fixed 200 cm BPLL with the results of 32 patients in whom the BPLL was optimized by measuring approximately 40% of the TSBL[46]. It should be noted that there were no statistically significant differences in % EWL and TWL between patients in both groups. However, the number of patients with vitamin A, vitamin D3, and albumin deficiencies was significantly higher in the group with a fixed 200 cm BPLL after 1 year. And the authors concluded that adjusting the BPLL by measuring 40% of the TSBL appears to be safe and effective and may even be superior to a fixed 200 cm BPLL. A similar study was conducted by *Abdallah E. et al. (2021)*[47], who compared the surgical outcomes of OAGB in patients with a fixed BPLL of 200 cm and OAGB with an individually tailored BPLL (proximal 1/3 of the TSBL). They found

better weight loss, similar resolution of comorbidities, and fewer nutritional problems (hypoalbuminemia) in the individually tailored group. The main results of the OAGB, when adapting the BPLL to the TSBL, are shown in Table 3.

Table 3.
Biliopancreatic limb length with measurement of the total small bowel length.

Author	Year	Number of patients, n	Follow-up, month	BMI before surgery, kg/m²	BPLL, cm	CLL, cm	%EWL
I.Komaei[46]	2019	32	12	45.0±6.9	40%ofTSBL	60% ofTSBL	63.3±13.7
E. Abdallah[47]	2022	40	12	49.7±9	1/3ofTSBL	2/3 ofTSBL	80.2±12.3
Eskandaros M.S.[48]	2022	214	24	>50	40%ofTSBL	60% ofTSBL	%TWL 48

To study the impact of OAGB with long BPLL on surgical outcomes in patients with extreme obesity, *Eskandaros M.S.* published the results of a 2-year follow-up study in 2022 in patients with a BMI greater than 50 kg/m² and a TSBL greater than 600 cm. The BPLL was 250 cm, and the CLL always remained greater than 350 cm, with a 40% / 60% BPLL / CLL ratio[49]. Remission of comorbidities, such as hypertension and diabetes, was observed for 2 years after surgery, without the development of severe malnutrition, while maintaining the target BMI.

According to *Ruiz-Tovar J. et al.,* when performing OAGB on their patients, they optimized the biliopancreatic loop length using the formula BPL = 50% * TBL + 50 cm[50]. Thus, the authors recommend using a CLL/TSBL ratio of 0.4 to 0.43. Within these ranges, patients achieved significant weight loss, a high remission rate of comorbidities, and no severe protein-calorie malnutrition or mortality.

The fixed common limb length

The first data on a fixed CLL were reported by *Kassir R. et al. (2021)*[51]. Between 2013 and 2015, he performed OAGB on 40 patients. However, 17 of these patients underwent «single-anastomosis gastro-ileal bypass with an omega loop» (OLGIBP / SAGI), which used a fixed CLL of 300 cm, while the remaining 23 patients underwent standard OAGB with a 200 cm common channel length. Comparing both groups, the authors concluded that OAGB is a simple, feasible, and safe malabsorptive bariatric procedure with good efficacy in reducing excess weight. Most importantly, the mid-term results of this small series show no mortality or complications associated with SAGI.

In 2017, *De Luca M.* published the technical details and preliminary results of the SAGI (single anastomosis gastro-ileal) procedure, in which the gastrointestinal anastomosis was created at a fixed distance of 300 cm from the ileocecal valve, adhering to the technical principles of performing OAGB. Despite the limited number of patients (n=7) and a short postoperative follow-up period of 3-6 months, the author reports excellent weight loss without bile reflux and no nutritional complications such as anemia and hypoproteinemia. The OAGB results with fixed total channel length, are shown in Table 4.

Table 4.
OAGB with fixed total channel length

Author	Year	Number of patients, n	Follow-up, month	BMI before surgery, kg/m²	CLL, cm	Weight loss
T. Nabil[52]	2019	30	12	54.9 ± 9.2	400	EBWL 69.4±15.4
T.C. Soong[53]	2019	47	12	39.8±7.4	400	EWL 83.3±51.5
R. Kassir[51]	2021	17	36	45.0	300	TWL 48.2±7.4
X.Qin[54]	2022	100	12	35.5±6.1	>400	EWL 85.4±13.2
E. Mostafapour[55]	2024	64	12	43.1±2.4	>400	TWL 36.7±5.86

In 2019, *Nabil T.* and co-authors conducted a randomized controlled trial with a 1-year postoperative follow-up[52]. In two groups of 30 patients, they compared standard OAGB with a 200 cm BPLL and OAGB with a fixed 400 cm CLL. There was no statistical difference in weight loss, but hemoglobin, cholesterol, triglyceride, iron, and albumin levels were significantly lower in the fixed CLL group. The authors conclude that a BPLL longer than 200 cm does not improve weight loss or resolution of comorbidities, and measuring TSBL is recommended to prevent excessive shortening of the small bowel, which increases the risk of nutritional complications. It should be noted that in both groups, the average TSBL was 720 cm (range, 600-1000 cm).

Soong T.C. compared the BMI-adapted BPLL with a fixed CLL of 400 cm after measuring the TSBL[53]. The results of the two groups regarding weight loss and remission of comorbidities were similar.

In 2022, *Qin X. et al.* reported the first experience of their original technique, where the gastrojejunostomy was fixed to the antrum of the stomach to prevent loop rotation, which they called «OAGB in situ»[54]. In all 100 cases, they used a fixed CCL of more than 400 cm. Weight loss and resolution of obesity-related comorbidities were satisfactory. Remission of type 2 diabetes mellitus was 100% (n=20). During follow-up, only one patient (1.0%) underwent reoperation for protein-calorie malnutrition and uncontrolled diarrhea 14 months after OAGB. This was a 51-year-old man with a preoperative BMI of 40.1 kg/m^2 and multiple comorbidities who underwent OAGB with a BPLL of 5 m and a CCL length of 5 m (TSBL of 10 m). After a repeat operation with the length of the BPLL increased to 2.5 m, the patient recovered without complications.

In 2024, *Mostafapour E.* and colleagues published the results of a prospective cohort study aimed to evaluate the effect of CCL on weight loss and the prevention of protein-calorie malnutrition after OAGB[55]. In 60 patients, with a fixed BPLL of 175 cm, the CCL was greater than 400 cm. Despite this, one case of hypoalbuminemia was recorded during a 1-year follow-up. Regarding anemia, its incidence in patients with a CCL greater than 400 cm was 26.7%. The authors conclude that a CCL of 400 cm does not completely prevent nutritional complications, but maintaining a CCL of 400 cm may reduce the risk of protein-calorie malnutrition after OAGB.

Limitations. This literature review has several limitations that should be acknowledged. First, as a literature review, our work is inherently limited by the methodological framework of narrative synthesis, without the rigorous statistical approach typical of meta-analysis. Although we followed the MOOSE guidelines for observational studies, a formal meta-analysis or systematic review with quantitative synthesis would have provided more compelling evidence on the associations between different methods of BPLL selection in OAGB and improved quality of life, expressed as weight loss and improvement in comorbidities. Furthermore, prospective randomized studies are lacking on BPLL selection during OAGB in morbidly obese Asian patients.

What's Known? The BPLL is one of the key technical variables in OAGB and is believed to influence both weight-loss efficacy and metabolic outcomes. Most published studies suggest that longer BPLs may enhance weight reduction and remission of type 2 diabetes, but they also potentially increase the risk of malabsorption and nutritional deficiencies. Current recommendations regarding optimal BPLL remain inconsistent, and no universally accepted standard exists in the literature.

What'sNew?

The review provides a detailed analysis of the scientific evidence regarding the relationship between BPLL and key clinical outcomes, including weight loss, remission of obesity-related comorbidities, and quality-of-life indicators. Modern surgical centers are increasingly moving away from fixed BPLLs and are adopting more flexible, individualized approaches. The review emphasizes the TSBL as a critical factor influencing surgical outcomes. Recent studies propose intraoperative measurement of the entire small intestine and calculation of the BPLL as a percentage of the total length, which may reduce the risk of severe malabsorption.

Conclusion

One-anastomosis gastric bypass has proven to be an effective and relatively safe treatment for morbid obesity and metabolic syndrome. However, the optimal BPLL remains controversial. The results of from most studies confirm that a fixed BPLL of 150–200 cm ensures satisfactory weight loss and remission of comorbidities with a low incidence of severe malabsorptive complications. Currently, there are no universal recommendations for choosing the BPLL. Optimization of surgical technique should be personalized and take into account individual anatomical features, initial BMI, age, and comorbidities of the patient. Multicenter randomized trials with long-term follow-up are needed to develop standardized approaches.

Acknowledgments. The authors would like to express their sincere appreciation to the Library Fund and the staff of the institutional scientific libraries.

Author Contributions: Sh.A.: research concept development, data analysis, manuscript writing, and editing; O.N.: clinical data collection and interpretation, literature review, and editing of the «Methods», «Results» sections; B.B., Dzh.A.: scientific concept, consultation, and study design. All authors have read and approved the final version of the manuscript and agree to be responsible for all aspects of the work.

Funding: None

Abbreviations: ALT – alanine transaminase; BMI – body mass index; BPL – biliopancreatic limb; BPLL – biliopancreatic limb length; CL – common limb; CLL – common limb length; EBWL – excessbody weight loss; EWL – excess weight loss; GGT – gamma-glutamyltransferase; OAGB – one anastomosis gastric bypass; SAGI – single anastomosis gastro-ileal bypass; TSBL – total small bowel length; TWL – total weight loss.

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