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Review Article

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Bariatric Surgery in Adolescents: Long-Term Outcomes and the Consent Conversation

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Abstract

Ten-year outcomes are now available for adolescents who underwent bariatric surgery in a prospective multicentre cohort of 161 gastric bypass and 99 sleeve gastrectomy patients operated at a mean age of 17, with 83 per cent of ten-year visits completed. Body mass index fell by 20.6 and 19.2 per cent respectively, and modelled remission at ten years was 55 per cent for type 2 diabetes, 57 per cent for hypertension and 54 per cent for dyslipidaemia. The diabetes figure exceeds what has been reported in adults at comparable follow-up. The obligations are equally durable. At three years, 57 per cent of the same cohort had low ferritin, 35 per cent low vitamin B12 and 16 per cent low vitamin A, and intra-abdominal reoperation over five years was more frequent in adolescents than adults. This review sets out the published outcomes and the arguments made about consent, without offering a view on whether any individual should undergo surgery.

Keywords: *Adolescent bariatric surgery; Long-term outcomes; Nutritional deficiency; Informed consent; Severe obesity*

Introduction

Severe obesity in adolescence carries substantial current and future morbidity, and non-surgical management achieves modest and often temporary weight reduction in this group [1,2,3]. Metabolic and bariatric surgery has been performed in adolescents for two decades, and guidance in several countries now supports it in defined circumstances [4,5,33]. National use in paediatric patients has been described in trend analyses [32], and the case for surgery in this age group has been argued and contested in review [25,31].

Objection to it has centred less on whether it works than on who is agreeing to it. The patient is a minor, the decision is irreversible, the obligations it creates last decades, and adolescence is the period in which engagement with health services is least reliable [6,7,8].

Ten-year outcome data are now available from the largest prospective cohort. This review sets out what those data show, what obligations accompany the benefit, and how the consent question has been argued. It offers no view on whether any individual patient should have surgery, which is a matter for that patient, their family and their clinical team.

Material and Methods

Search strategy: PubMed and the archives of the major surgical, paediatric, endocrinology and clinical ethics journals were searched for studies of bariatric surgery in adolescents. Search terms combined adolescent and paediatric bariatric or metabolic surgery with long-term outcomes, nutritional deficiency, reoperation and consent. Reference lists of the ten-year cohort report [9] and current guidance [4] were screened by hand for primary sources.

Eligibility: Studies were included if they reported clinical outcomes in adolescents undergoing these procedures, compared adolescents with adults, or set out ethical arguments about consent in this population. Ethical positions are reported as arguments made in the literature and are identified as such.

Data extraction and handling: Design, cohort, procedure, follow-up duration and the reported outcome were extracted as

published. Follow-up completeness is stated alongside every long-term estimate, since attrition is the principal threat to these figures. This review reports published outcomes and published arguments. It does not recommend or advise against surgery for any individual, and it gives no guidance on patient selection, nutritional management or supplementation, which are matters for the treating team. No pooling or re-analysis was performed. Figures 1 to 6 and Tables 1 to 3 reproduce published values only. This is a narrative synthesis and was not registered as a systematic review.

Results

The cohort: A prospective multicentre observational study enrolled adolescents aged 19 or under, of whom 161 underwent gastric bypass and 99 sleeve gastrectomy, at a mean age of 17 years. Eighty-three per cent of those eligible completed ten-year follow-up [9,10]. At ten years, body mass index had fallen by 20.6 per cent after gastric bypass and 19.2 per cent after sleeve gastrectomy (Figure 1) [9,11].

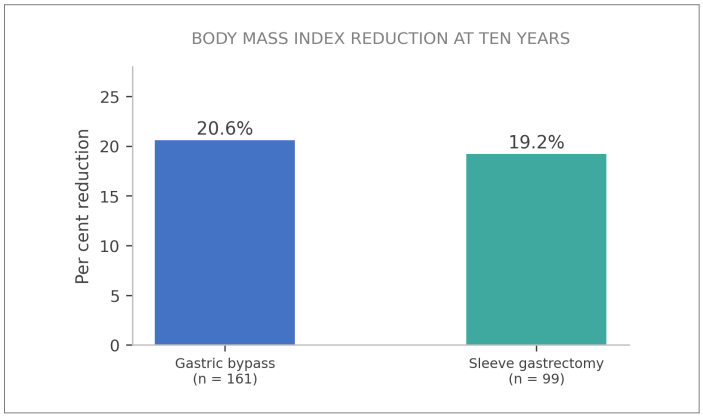

Figure 1: Body mass index reduction at ten years, by procedure [9,11]

Comorbidity remission: Modelled remission rates at ten years were 55 per cent for type 2 diabetes (95% CI 35 to 75), 57 per cent for hypertension (39 to 75) and 54 per cent for dyslipidaemia (42 to 66) (Figure 2) [9]. At three years the same cohort had shown remission of type 2 diabetes in 95 per cent (85 to 100), with no new cases among those without the condition at baseline, and remission of prediabetes in 76 per cent of 19 participants [11,12].

Table 1: Adolescents compared with adults, as reported by the original investigators

Table 2: Three-year outcomes in the same cohort [11,15,16]

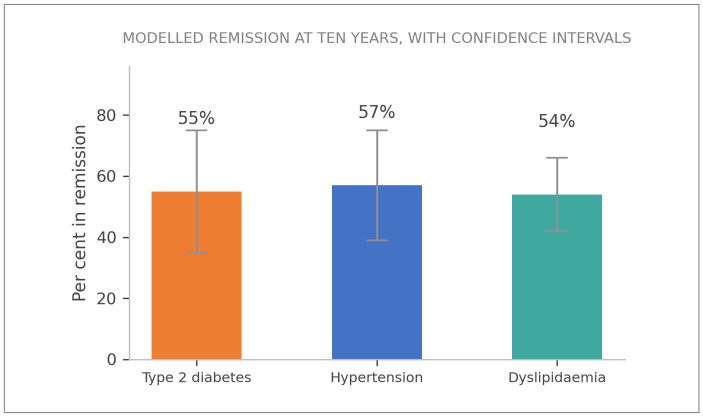

Figure 2: Modelled remission at ten years with confidence intervals [9]

The comparison with adults: The investigators noted that type 2 diabetes remission at ten years exceeded the 18 and 12 per cent reported in adults at seven and twelve years respectively in a multicentre randomised trial (Figure 3) [9,13]. A single-institution retrospective comparison of 76 adolescents and 74 adults reported greater reduction in body mass index and weight in adolescents at all time points, and greater resolution of type 2 diabetes and hypertension at four years [14,30]. Cardiovascular risk factors after surgery in this cohort improved substantially [26], and a Swedish nationwide prospective study reported five-year outcomes independently [23].

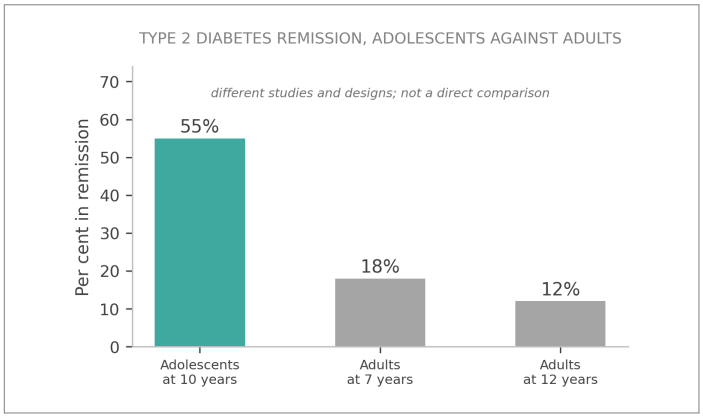

Figure 3: Type 2 diabetes remission in adolescents against reported adult figures [9,13]

Nutritional consequences: Three years after surgery, 57 per cent of the cohort had low ferritin, 35 per cent low vitamin B12 and 16 per cent low vitamin A (Figure 4) [15,16]. Without supplementation, deficiency of these nutrients is associated with peripheral neuropathy, weakness, menstrual disturbance and reduced bone density, and the concern is described as amplified in a still-developing adolescent [15,17,29]. Nutritional risks in this cohort have been characterised in a dedicated analysis [29], and adherence to supplementation after surgery is itself low [20].

Table 3: Considerations described in the published discussion of this question

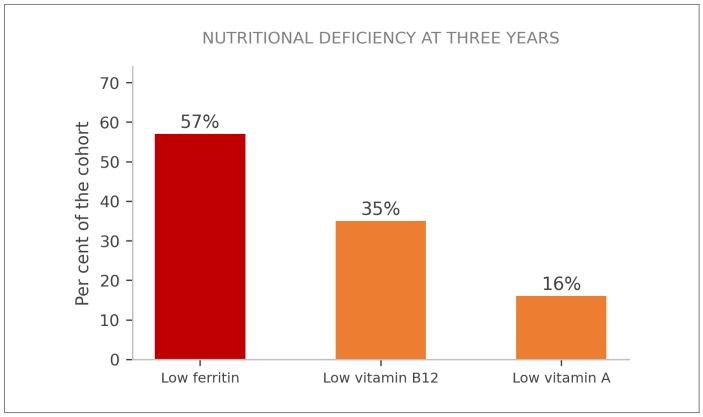

Figure 4: Nutritional deficiency at three years [15,16]

Reoperation: Reoperation for any reason was approximately 13 per cent by three years, and intra-abdominal reoperation over five years was more frequent in adolescents than adults, at 20 against 16 per cent (Figure 5) [16,18]. A comparison of the adolescent cohort with adults who had been obese as adolescents but underwent surgery later reported similar weight loss overall, with greater variability in maintenance and more abdominal reoperations and nutritional deficiencies in the adolescent group [15,19].

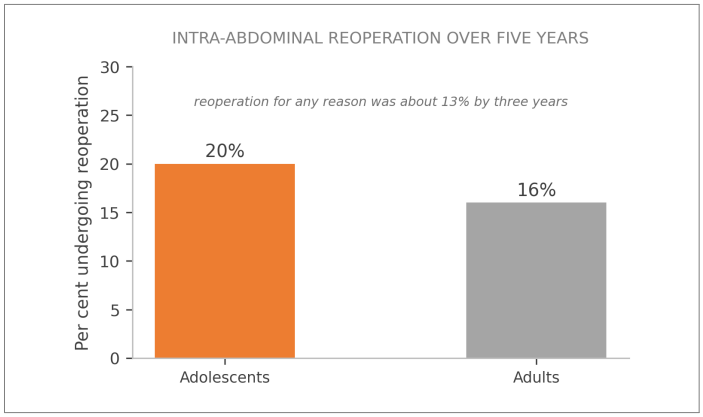

Figure 5: Intra-abdominal reoperation over five years [16,18]

Outcome	Adolescents	Adults
Weight loss at five years	Similar and durable	Similar and durable [19]
Type 2 diabetes remission	55% at 10 years	18% at 7, 12% at 12 years [9,13]
Intra-abdominal reoperation	20% at 5 years	16% at 5 years [18]
Nutritional deficiency	More frequent	Less frequent [15,19]
Variability in maintenance	Greater	Less [19]

Follow-up as the limiting factor: Adolescents are described as having lower rates of attendance for medical follow-up than adults, which matters because the nutritional consequences of these procedures require indefinite monitoring and supplementation [15,20]. The period after surgery coincides with the transition from paediatric to adult services, itself associated with disengagement [8,21]. Mental health and eating pattern outcomes have been followed to five years, and psychological vulnerability in this population predates surgery [27,28].

What the consent discussion has to cover: Commentary on this literature emphasises that the decision extends across three distinct domains: benefits that are durable, obligations that are equally durable, and a timing question, since the decision is taken in adolescence but experienced across subsequent decades (Figure 6) [6,7,22]. Authors have argued that separating surgical and medical pathways into parallel systems is unhelpful and that decisions should be made by a multidisciplinary team considering all available therapies together [17,23].

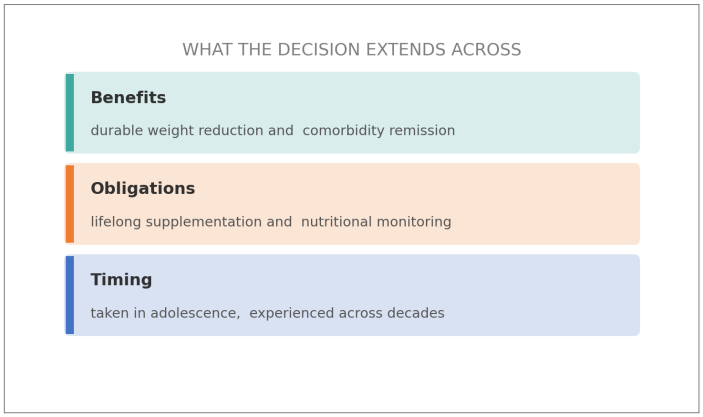

Figure 6: Domains the decision extends across, as set out in commentary [6,7,22]

Reported at three years	Value
Type 2 diabetes remission	95% (95% CI 85 to 100)
Prediabetes remission	76% of 19 participants
Low ferritin	57%
Low vitamin B12	35%
Reoperation for any reason	About 13%
Consideration	**As set out in the literature**
Benefit magnitude	Greater than expected in similar adults [9]
Durability	Sustained at ten years for most [9]
Nutritional obligation	Indefinite, and adherence is lower in this group [15,20]
Reoperation risk	Higher than in adults over five years [18]
Alternatives	Should be weighed together, not in parallel silos [17,23]

Discussion

The outcome evidence is stronger than the debate around it often assumes. At ten years, body mass index remained around 20 per cent below baseline and more than half of those with type 2 diabetes, hypertension or dyslipidaemia were in remission, with 83 per cent follow-up completeness in a cohort operated at a mean age of 17 [9]. The comparison the investigators drew with adult remission rates points the same way, though it sets separate studies alongside one another rather than comparing within a trial [9,13].

The obligations are the part that the outcome figures do not convey. Fifty-seven per cent of the cohort had low ferritin at three years, and deficiency in this population is not a transient postoperative phenomenon but a permanent feature of altered absorption requiring lifelong supplementation and monitoring

[15,17]. Reoperation was more frequent than in adults over the same period [18].

Those two facts are what make the consent question genuinely difficult rather than merely procedural. The benefit accrues over decades and so does the requirement, and the requirement falls on a person whose engagement with health services is, developmentally and empirically, least reliable during exactly the years that follow [8,20,21]. This is the same disengagement documented in the transition from paediatric to adult services, arriving here attached to a nutritional dependency rather than to a prescription.

Commentary in this literature has argued for a specific structural change rather than a restriction: that surgical and medical management should not be delivered as parallel silos, and that decisions should be made by a multidisciplinary team weighing all available therapies on their merits [17,23]. That argument has gained force as pharmacological options for adolescents have expanded, since a decision made when surgery was the only effective option is a different decision from one made now [3,24]. Randomised evidence for pharmacotherapy in adolescents now exists [24], and comparative effectiveness between procedures has been examined in large registry data [30]. Long-term mortality benefit in adults provides the background against which these decisions are framed [34].

A note on what this review deliberately does not do. It reports outcomes and reproduces arguments. Whether a particular young person should undergo surgery depends on their circumstances, their comorbidity, the alternatives realistically available to them, and their own and their family's understanding of what follows, none of which a review can assess. The literature is clear that this belongs to a multidisciplinary discussion with the patient and family, and this article takes no position within it [4,17,23].

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Study limitations

The limitations belong to the underlying literature. The principal cohort is prospective but observational, with no randomised comparison against non-surgical management, so selection differences between those who did and did not undergo surgery cannot be excluded [9,10]. Follow-up at ten years was 83 per cent, which is high for this population but leaves outcomes in the remainder unknown and plausibly different [9]. Comparisons with adults set separate cohorts alongside one another rather than randomising, and the adult figures come from a differently designed trial [9,13]. The single-institution comparison involves 76 adolescents and 74 adults and is retrospective [14]. Nutritional data are reported at three years, and longer-term deficiency rates in this cohort are less completely described [15,16]. Randomised evidence in younger adolescents is awaited rather than available [3,24]. Procedures and perioperative care have changed over the period these cohorts span [18,19]. And the ethical arguments summarised here are positions taken in commentary rather than empirical findings, and are reported as such [6,7,22].

Conclusion

Ten-year data show durable benefit after bariatric surgery performed in adolescence: body mass index around 20 per cent below baseline and remission of type 2 diabetes, hypertension and dyslipidaemia in more than half, with diabetes remission exceeding figures reported in adults at comparable follow-up. The same cohort shows the other side of the ledger, with 57 per cent having low ferritin at three years and intra-abdominal reoperation more frequent than in adults. What makes consent here substantively rather than procedurally difficult is that both the benefit and the obligation extend across decades, and the obligation falls during the years when engagement with services is least reliable. The published argument is for multidisciplinary decisions weighing all available therapies together rather than for restriction, and that argument has strengthened as the alternatives have multiplied.

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Conflict of Interest

The authors declare no competing interests.

Ethics Statement

This article reviews previously published studies only. No new patient data were collected and no participants were recruited, so ethical approval was not required.

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