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Comparison of Cosmetic Results in Children >10 Years Old Undergoing Open, Laparoscopic or Robotic-Assisted Pyeloplasty: A Multicentric Study

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Study Need and Importance: Minimally invasive pyeloplasty (MIP), including laparoscopic pyeloplasty (LP) and robotic-assisted laparoscopic pyeloplasty (RALP), has become increasingly popular. Reportedly, MIP has success and complication rates comparable to open pyeloplasty (OP), and therefore potential advantages have to be searched for in secondary outcomes. Improved cosmesis is often claimed as a major advantage of MIP, and older children and adolescents are generally considered the patients who could benefit the most of MIP. This is the first multicentric study comparing patient perception of surgical scars using a validated Patient Scar Assessment Questionnaire (PSAQ) in children >10 years old undergoing OP, LP or RALP.

What We Found: Of 227 eligible patients, 114 (50%) participated, including 37 (32%) OP, 30 (26%) LP and 47 (41%) RALP. Median (IQR) followup was 5.2 (2.3–7.8) years. The PSAQ score was within the first quartile, the most favorable, in 90 (79%) patients without difference among approaches. LP

achieved significantly better PSAQ scores, whereas no difference was observed between RALP and OP (see table). More than half of the patients undergoing OP reported scar related symptoms. Median scar length at followup was significantly larger after OP where it correlated with body mass index, whereas it did not do so after MIP.

Limitations: Collection of some clinical data was retrospective and patient reported outcome questionnaires are keen to bias. Results might be largely modified by the outcomes in nonrespondents. The occurrence of some variables might have been too small to reach statistical significance. Results might be different after pyeloplasty in infancy.

Interpretation for Patient Care: Patients were generally satisfied with scar appearance; therefore, this study does not support the hypothesis that, in this age group, MIP allows for better cosmetic results than OP. OP incisions were more commonly associated with scar-related symptoms. MIP might be advisable in overweight and obese patients.

Scores of PSAQ

	Overall	OP	LP	RALP	p Value
No. pts	114	37	30	47	
Median PSAQ (IQR)	42 (37–48)	43 (39–48)	41 (34–43)	43 (38–50)	0.03*
Median appearance (IQR)	15 (13–16)	15 (13–16)	14 (12–15)	15 (14–18)	0.002*
Median consciousness (IQR)	9 (8–11)	10 (8–11)	8 (7–10)	9 (8–10)	0.09
Median satisfaction with appearance (IQR)	12 (9–15)	12 (9–15)	11 (8–14)	13 (9–16)	0.13
Median satisfaction with symptoms (IQR)	5 (5–7)	6 (5–7)	5 (5–6)	5 (5–6)	0.49

* Significant for p value ≤0.05.

Comparison of Cosmetic Results in Children > 10 Years Old Undergoing Open, Laparoscopic or Robotic-Assisted Pyeloplasty: A Multicentric Study

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Purpose: Our goal was to compare surgical scars assessed by a validated patient reported outcome questionnaire in children undergoing open (OP), laparoscopic (LP), or robotic-assisted (RALP) pyeloplasty. Our secondary aim was to assess the influence on the outcomes of variables such as gender or body mass index (BMI).

Materials and Methods: We conducted an observational, cross-sectional, multicentric study of patients undergoing primary pyeloplasty between age 10 and 18 years at 5 tertiary Italian institutions during the period January 2010 to December 2019. Of 227 eligible patients 114 (50%) participated. OP was performed in 37 (32%), LP in 30 (26%) and RALP in 47 (41%). After a median (IQR) followup of 5.2 (2.3–7.8) years, scars were measured and assessed by a validated Patient Scar Assessment Questionnaire. Scores were compared among techniques and in accordance with several variables.

Results: The median length of the surgical scar at followup was significantly larger ($p < 0.0001$) after OP (8.1 cm vs 1.8 cm for LP and 2.0 cm for RALP), where scar length correlated with BMI ($p = 0.04$). Ninety patients (79%) had a Patient Scar Assessment Questionnaire score within the first quartile, the most favorable. During followup, 43 (38%) participants reported scar-related symptom. Symptoms were generally more common after OP (54% vs 30% for LP and 30% for RALP, $p = 0.06$) and scar hyperesthesia was significantly more frequent after OP ($p = 0.01$).

Conclusions: Perception of the cosmetic outcomes in pre-adolescents and adolescents after pyeloplasty was generally good. LP achieved the best cosmetic results. OP was more commonly associated with scar-related symptoms and the size of the incision paralleled BMI.

Key Words: hydronephrosis, laparoscopy, patient reported outcome measures, validated questionnaire, robotic surgical procedures

OPEN pyeloplasty (OP) is a common approach in infants and young children.^{1,2} In older children and adolescents, instead, minimally invasive pyeloplasty (MIP) has taken over in popularity.¹ Robotic-assisted laparoscopic pyeloplasty (RALP) is now the

preferred form of MIP as it overcomes the challenges associated with intracorporeal suturing in standard laparoscopic pyeloplasty (LP).^{3,4} The latter, however, has the putative advantages of requiring smaller incisions, as small as 3 mm, and being more cost-effective.^{5–7}

Abbreviations and Acronyms

BMI = body mass index

LP = laparoscopic pyeloplasty

MIP = minimally invasive pyeloplasty

OP = open pyeloplasty

PSAQ = Patient Scar Assessment Questionnaire

RALP = robotic-assisted laparoscopic pyeloplasty

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Comparative studies have shown that the success and complication rates of MIP are not significantly different from those of OP.^{8–10} Therefore, the potential advantages of each approach have to be looked for among the secondary outcomes.¹⁰ Cosmetic outcomes are generally considered as a major advantage of MIP over OP. To our knowledge, 3 studies have specifically focused on this issue to date. In 2013 Barbosa et al reported that, based on the preoperative assessment of diagrams and pictures, parents and patients more commonly prefer RALP scars to OP scars.¹¹ Similar conclusions were drawn by Gargollo in 2011 in a series of 7 patients undergoing a modified RALP assessed using a validated wound and scar evaluation scale.¹² In 2018 Wang et al instead reported that MIP scars are smaller and tend to grow less over time than OP scars, but the approach did not prove to be a significant factor influencing long-term patient/parent satisfaction.¹³

The aim of this study was to compare surgical scars using a validated patient reported outcome questionnaire in children >10 years undergoing OP, LP or RALP. The secondary objective was to assess the influence of factors such as gender or body mass index (BMI) on the outcomes.

Our testing hypotheses were that, in this age group, LP and RALP allow for better cosmetic results than OP, and might be particularly beneficial in females and in patients with a greater BMI.

MATERIAL AND METHODS

Study Population

This was an observational, cross-sectional, multicentric study. Pediatric urology units from 5 Italian tertiary care hospitals participated.

Following Institutional Review Board exemption, patients aged 10 to 18 years who had undergone OP, LP or RALP between January 2010 and December 2019 were included in the study. Patients with incomplete data, with followup <6 months, undergoing redo pyeloplasty (after first referral or for failure of primary surgery at the same institution) or with a history of other abdominal surgeries, cognitive issues or skeletal deformities were excluded.

Intervention

At all centers, OP was performed retroperitoneally via a subcostal incision below the 12th rib using a muscle-cutting approach. LP was performed transperitoneally using 3 or 4, 5 mm ports. RALP was performed transperitoneally, generally using 3 robotic ports and 1, 5 mm laparoscopic port for the assistant.

Study Protocol

Medical records were reviewed in order to collect data regarding age at surgery, side of surgery, BMI, surgical technique and additional surgeries.

Eligible patients and their legal guardians were telephonically invited to participate in the study. An email containing the link for an online questionnaire was sent to those who agreed to participate. After 2 weeks a reminder

was sent before excluding the patient from study. Data collection started in May 2020 and ended in November 2020.

The online questionnaire, prepared using Google Form® tools, was comprised of 3 parts. In the first, written informed consent to participate was obtained. The second part included the items of the Patient Scar Assessment Questionnaire (PSAQ).¹⁴ This is a multiple-choice questionnaire validated to assess the patient's perception of surgical scars. The PSAQ includes 39 items subdivided into 5 subscales: "appearance," "symptoms," "consciousness," "satisfaction with appearance" and "satisfaction with symptoms" (supplementary Appendix 1, <https://www.jurology.com>). An overall score is obtained from the sum of subscale scores, excluding the "symptoms" subscale. The PSAQ score can range between 28 and 112, and higher scores reflect a poorer perception of the scar. In the last part, patients were given the option of uploading a photograph of their scar next to a ruler. In order to standardize the picture, detailed information was given about how to position the ruler and the camera.

Grouping, End Points and Variables

Participants were divided into 3 groups according to pyeloplasty technique: OP, LP or RALP. Comparability of groups was checked in terms of gender distribution, side of surgery, age at surgery, BMI (defined as normal <25, overweight between 25 and 30 and obese >30) and length of followup.

End points for comparison among groups included length of the scars at followup, PSAQ scores (overall and for each subscale) and scar-related symptoms.

The following variables, selected a priori, were tested as determinants of outcome: for the length of the scars at followup—BMI and the length of followup; for the PSAQ score and scar-related symptoms—gender, age at surgery, BMI, length of followup and the length of the surgical scar at followup. Scar-related symptoms were also assessed in relation to the PSAQ score and the score for the PSAQ subscales of "appearance," "consciousness" and "satisfaction with appearance."

Statistical Analysis

Data were recorded in a Microsoft® Excel® database and the statistical analysis was carried out using IBM® SPSS Inc. Version 26.0 (IBM, Armonk, New York). Categorical variables were reported as percentages while continuous variables were reported as median and range or interquartile range (IQR). For comparison among groups, Pearson's and chi-squared tests were used for categorical variables, and Mann-Whitney U and ANOVA tests for continuous variables. Linear regression models were created to assess potential correlations between continuous variables. A p value ≤0.05 was considered statistically significant.

RESULTS

Eligible Patient and Study Sample

A total of 216 patients (142, 66% males) matched the study criteria. Median (IQR) age at surgery was 14.3 (11.7–16.4) years. The surgery was on the left side in 121 (56%) patients and included OP, LP and RALP in 63 (29%), 76 (35%) and 77 (36%) patients, respectively. Median (IQR) followup was 5.2 (2.3–7.8) years.

Table 1. Characteristics of the 114 participants

	Overall	OP	LP	RALP	p Value
No. pts	114	37	30	47	
No. female gender (%)	44 (39)	17 (46)	8 (27)	19 (40)	0.26
No. rt side (%)	53 (46)	15 (41)	11 (37)	27 (57)	0.14
Median kg/m ² BMI (IQR)	21.0 (19.4–23.3)	22.7 (21.2–23.8)	21.5 (19.8–24.4)	20.0 (18.6–21.6)	0.07
Median yrs age at surgery (IQR)	14 (11–16)	14 (12–16)	14 (11–16)	15 (12–16)	0.30
Median yrs followup (IQR)	5.1 (2–3–7.7)	6.4 (5.3–9.0)	5.0 (2.8–6.7)	3.1 (1.5–6.8)	<0.001*

* Significant for p value ≤ 0.05 .

Of 216 eligible patients 3 (1.4%) declined to participate, 99 (45.8%) could not be reached or failed to return the questionnaire and 114 participated. The response rate was 52.8% (supplementary Appendix 2, <https://www.jurology.com>). Characteristics were not significantly different between respondents and nonrespondents, apart from the number of LPs, which was significantly higher among nonrespondents ($p=0.004$; supplementary Appendix 3, <https://www.jurology.com>).

Of the 114 participants 37 (32%) underwent OP, 30 (26%) LP and 47 (41%) RALP. The 3 study groups were comparable but for a significantly shorter ($p < 0.001$) followup in patients who underwent RALP, the most recent technique (table 1). BMI was higher than 25 kg/m² in 12 patients (10.5%) and above the threshold for obesity in 2 (1.8%).

Length of Surgical Scars at Followup

The optional photograph of the scars was uploaded by 27 of 37 (73%) OP, 6 of 30 (20%) LP and 29 of 47 (62%) RALP patients. The median length of the surgical scar was significantly larger ($p < 0.0001$) in patients who underwent OP (8.1 cm, range 5.0–13) vs LP (1.8 cm, range 1.0–2.5) or RALP (2.0 cm, range 1.0–3.0), whereas it was not significantly different ($p=0.95$) between the latter 2. The length of the scar correlated with BMI in patients who underwent OP ($p=0.04$; table 2) whereas it did not in those who underwent LP or RALP ($p=0.86$ and 0.08, respectively). The length of the surgical scar did not correlate with the length of followup in any group (table 2).

PSAQ Scores (Overall and Appearance)

The median (IQR) PSAQ score was 42 (36–48) and 90 patients (79%) were in the first quartile (the most favorable) of possible scores, including 29 out of 37 (78%) OP, 25 out of 30 (83%) LP and 36 out of 47 (76%) RALP ($p=0.77$). The PSAQ score was significantly lower in the LP group (table 3), whereas it was not significantly different between OP and RALP ($p=0.74$).

The figure shows examples of scar appearance for the different PSAQ scores.

Regarding the PSAQ subscales, a significant difference was observed for the “appearance” subscale,

whereas no difference was seen for the other subscales (table 3).

The median (IQR) PSAQ score did not differ between males and females, 42 (38–47) vs 41 (34–51), respectively ($p=0.079$), and linear regression analysis did not reveal any significant correlation between the PSAQ score and patient age at surgery, BMI or length of the surgical scar at followup (table 4). A correlation was found between the PSAQ score and length of followup considering the cases overall, but not when considering each group independently.

Symptoms Related to Surgical Scars

During followup, 43 (38%) of the 114 participants reported suffering from symptoms related to the surgical scar, including 25 who reported 1 symptom and 18 more than 1 symptom (table 5). Median followup in symptomatic patients was 4.9 years (range 0.5–11). The most common symptoms were itching and hypoesthesia, reported by 24 (21%) and 19 (17%) patients, respectively.

Although not statistically significant ($p=0.06$), symptoms were more commonly reported after OP, 20 (54%) out of 37 cases, than after LP or RALP, 9 (30%) out of 30 and 15 (32%) out of 47 patients, respectively. Scar-related hyperesthesia was significantly more common after OP ($p=0.01$; table 5).

The presence of symptoms did not influence the PSAQ score (supplementary Appendix 4, <https://www.jurology.com>).

Table 2. Results of linear regression to assess correlation between length of scar at followup and age at surgery, BMI and length of followup

	R ²	p Value
Age at surgery:		
OP	0.01	0.64
LP	0.12	0.77
RALP	0.01	0.76
BMI:		
OP	0.10	0.04*
LP	0.009	0.86
RALP	0.12	0.08
Followup:		
OP	0.06	0.22
LP	0.17	0.41
RALP	0.05	0.27

* Significant for p value ≤ 0.05 .

Table 3. PSAQ scores, overall and per group

	Overall	OP	LP	RALP	p Value
No. pts	114	37	30	47	
Median PSAQ (IQR)	42 (37–48)	43 (39–48)	41 (34–43)	43 (38–50)	0.03*
Median appearance (IQR)	15 (13–16)	15 (13–16)	14 (12–15)	15 (14–18)	0.002*
Median consciousness (IQR)	9 (8–11)	10 (8–11)	8 (7–10)	9 (8–10)	0.09
Median satisfaction with appearance (IQR)	12 (9–15)	12 (9–15)	11 (8–14)	13 (9–16)	0.13
Median satisfaction with symptoms (IQR)	5 (5–7)	6 (5–7)	5 (5–6)	5 (5–6)	0.49

*Significant for p value ≤ 0.05 .

No statistically significant difference was found with respect to gender, age at surgery, BMI, length of followup or length of the scars when comparing symptomatic and asymptomatic patients, regardless of the surgical technique (table 6).

DISCUSSION

This multicentric study is the first, to our knowledge, to compare scar outcomes by means of a validated patient reported outcome questionnaire in pre-adolescents and adolescents who underwent pyeloplasty using the currently most common techniques, OP, LP and RALP. Cosmetic results were good for all the techniques. LP, which requires the

smallest incisions, obtained the best results; OP, instead, was more commonly associated with scar-related symptoms.

In this study, we administered the PSAQ to children >10 years old at pyeloplasty. The PSAQ questionnaire was chosen because of its good psychometric properties,¹⁴ especially for the “appearance” subscale, which we expected to be important.¹⁵ The age range, instead, was chosen for multiple reasons. To begin with, at present, MIP is used more commonly in this age group of patients.¹ Second, these are the patients who might benefit the most from MIP; in younger children, MIP is technically more demanding, whereas OP can be performed more quickly via a small incision, and the benefits in terms of postoperative pain



Examples of scars for different PSAQ scores.

Table 4. Assessment of a priori selected variables on outcome PSAQ score

	p Value	R ² (114 pts)	OP p (R ²) (37 pts)	LP p (R ²) (30 pts)	RALP p (R ²) (47 pts)
Age at surgery	0.32	0.009	0.37 (0.02)	0.93 (0.0003)	0.82 (0.001)
BMI	0.18	0.02	0.44 (0.02)	0.81 (0.002)	0.66 (0.004)
Length of followup	0.02*	0.05	0.23 (0.04)	0.08 (0.10)	0.14 (0.04)
Length of surgical scar	0.67	0.003	0.11 (0.10)	0.40 (0.18)	0.42 (0.02)

* Significant for p value ≤ 0.05 .

are also less evident.^{2,16} Still, cosmetic results could be more relevant for older patients who may be more aware of any changes in their physical appearance.¹⁷ Finally, results are possibly more reliable in these patients who, expectedly, are more capable than younger children of understanding the questions of the PSAQ and describing the outcomes.

Overall, patient perception of cosmetic outcomes was generally good regardless of the surgical technique. This is in keeping with the results obtained by Wang et al, who reported that the approach is not a factor that influences long-term patient/parent satisfaction.¹³ In contrast, Barbosa et al and Gargollo both reported that, based on drawings and/or pictures of the scars, patients and parents generally prefer the surgical scars of robotic surgery.^{11,12} We emphasize that preferences based on the assessment of pictures and the patients' perception of their own scars may not necessarily correspond. As the figure suggests, it is not always possible to correlate scar appearance with the PSAQ score. A possible explanation for the similar PSAQ outcome irrespective of the technique is that MIP scars have the advantage of being smaller; however the sub-costal incision is quite posterior and, as such, it is not directly visible when the patient looks down at their abdomen.

Two reasons, instead, might account for the better results of LP compared to RALP. First, the RALP instruments, which were not devised for pediatric patients, require larger incisions; 5 mm robotic instruments are also available,¹⁸ but they have a pulley system that limits articulation and precludes certain movements, thereby losing a major advantage of robotic surgery.¹⁹ Second, wound tension, applied to laparoscopic sites, is weaker and this might allow for better healing of the incisions.²⁰

We also investigated scar-related symptoms. Symptom rates were not statistically different among techniques, but patients who underwent OP reported symptoms more frequently and hyperesthesia was significantly more common after OP. This might be due to the longer surgical incisions. Of note, the presence of symptoms did not adversely affect the PSAQ scores.

Regarding variables influencing the outcome, age at surgery did not prove to be a determinant factor. Age at surgery, however, was also an inclusion

criterion in this study, and therefore the age range was quite narrow. Our results did not support female gender as being a factor in favor of a minimally invasive approach.²¹ In adults, obesity has been shown to increase the risk of complications²² and worsen cosmetic outcomes.^{23,24} In our study, BMI did not influence the PSAQ score. It should be emphasized, however, that the number of overweight/obese patients was small. Notably, BMI directly influenced the length of the incision in OP, whereas it did not do so in LP or RALP. In our opinion, this is an argument in favor of MIP for patients with higher BMI. Finally, we would have expected the outcome to improve during followup and, once again, this was not the case in this study.

Major limitations of our study include the possible bias inherent to any patient reported outcome questionnaire. Moreover, due to the retrospective collection of preoperative data, we were unable to gauge the importance of preoperative symptoms on the PSAQ score. More importantly, even though our 50% response rate was quite good, our results might have been largely modified by the outcomes in non-respondents. In this regard, it is important to emphasize the larger number of LP among non-respondents. Still, our data on age of patient at surgery and current scar length may be skewed, as results might be different if we looked at infants and revisited them as adolescents. This study also lacked a group of patients who underwent mini-LP using 3 mm instruments or RALP using 5 mm instruments. In our practice, however, the mini-LP is performed only in younger patients.⁴ Results might also have been different after OP if a posterior dorsal incision

Table 5. Symptoms related to surgical scars

	Overall	OP	LP	RALP	p Value
No. pts	114	37	30	47	
No. 1 symptom (%)	44 (39)	20 (54)	9.0 (30)	15 (32)	0.06
No. more than 1 symptom (%)	19 (17)	8.0 (22)	3.0 (10)	8.0 (17)	0.45
No. itch (%)	24 (21)	10 (27)	6.0 (20)	8.0 (17)	0.53
No. pain (%)	5.0 (4.4)	3.0 (8.1)	0 (0)	2.0 (4.3)	0.63
No. bother (%)	8.0 (7.0)	5.0 (14)	0 (0)	3.0 (6.4)	0.19
No. hypoesthesia (%)	19 (17)	9.0 (24)	1.0 (3.3)	9.0 (19)	0.06
No. hyperesthesia (%)	9.0 (7.9)	7.0 (19)	1.0 (3.3)	1.0 (2.1)	0.01*
No. discomfort (%)	12 (11)	3.0 (8.1)	3.0 (10)	6.0 (13)	0.82

* Significant for p value ≤ 0.05 .

Table 6. Comparison of variables between patients with and without symptoms

	Symptoms		No Symptoms		p Value	OP with Symptoms		LP with Symptoms		RALP with Symptoms		p Value
No. pts	43		71			20		9		14		
No. females (%)	15	(35)	28	(39)	0.38	9	(45)	0	(0)	6	(43)	0.10
Median yrs age at surgery (IQR)	14	(11–15)	14	(11–16)	0.36	14	(12–16)	14	(11–16)	14	(12–15)	0.51
Median kg/m ² BMI (IQR)	21.2 (18.9–22.8)		21.0 (19.6–23.7)		0.45	21.9 (18.7–23.0)		19.8 (19.1–21.5)		21.0 (17.8–23.0)		0.71
Median yrs followup (IQR)	4.3	(2.1–6.9)	5.9	(2.8–7.7)	0.49	5.3	(2.6–8.4)	3.6	(1.1–4.2)	2.4	(1.4–4.0)	0.07
Median cm length of surgical scar (IQR)	5.0	(2.0–7.3)	2.0	(2.0–6.0)	0.12	8.0	(6.0–11.0)	1.5	(1.5–2.0)	2.0	(2.0–2.5)	<0.001*

* Significant for p value ≤ 0.05 .

had been used. Still, as mentioned before regarding BMI, the occurrence of some variables may have been too small to reach statistical significance, as may have been the case for the correlation between the PSAQ scores and the length of followup. This is an issue in all pediatric research and the reason for which this study was multicentric in design.

CONCLUSIONS

The perception of cosmetic outcomes in pre-adolescents and adolescents after pyeloplasty was generally good for all the approaches. LP

scars rated best, whereas no difference was observed between RALP and OP. Patient perception was not inversely related to incision length, which did not seem to correlate with the length of postoperative followup. OP incisions were more commonly associated with scar-related symptoms. OP incision paralleled BMI, whereas RALP and LP incisions did not. Therefore, this study does not support the hypothesis that, in this age group, MIP allows for better cosmetic results than OP. MIP might be advisable in overweight and obese patients.

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EDITORIAL COMMENTS

As my residents will attest, I obsess over the location and length of every incision I make in children. This paper would suggest my anxiety is in vain. Patients are generally happy with their incisions years after successful surgery, regardless of approach.

This study's value is its long-term assessment of scar perception. Previous literature has not evaluated such long-term outcomes. Barbosa et al sought opinions of patients (a notably younger population than the current study) and parents comparing photographs of open vs robotic incisions of 3 different surgeries.¹ Not surprisingly, families preferred smaller incisions. Gargollo evaluated novel robotic trocar placement for pediatric kidney surgery in 12 patients (mean age 11 years).² Families evaluated their incisions compared to photos of open or traditional laparoscopic trocar placement 3 months after surgery. The current authors evaluated patient and parent perception of open, laparoscopic and robotic pyeloplasty scars in 114 patients. Patients were a median age of 14 years at surgery. Scar assessments were completed a median of 5.1

years after surgery. Patients rate all incisions favorably. Open flank incisions are rated similarly to robotic incisions. Laparoscopic incisions are rated the most favorably, but differences between the laparoscopic and other approaches are small.

A caveat to the current study: in selecting older children for the inclusion criteria, data on scar length may be skewed. The results may be different if infants who had surgery were revisited as adolescents.

Overall, the authors present as close to a real-world view on scar assessment as we have in pediatric urology. The study reinforces the conclusion of Wang et al.³ I propose we shift our energy from debating incision(s) location to solidifying who needs surgery in the first place, how to maximize functional outcomes and how to minimize complications.

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One of the presumed advantages of minimally invasive pyeloplasties over open surgery is the improved cosmesis due to smaller surgical scars that can be effectively hidden using techniques such as HiDES.¹ Increasingly, though, third parties are demanding evidence to support these assumptions to justify the increase in cost.

In this well-conceived study, Ghidini et al compared the cosmetic results of open, laparoscopic and robotic-assisted pyeloplasties by surveying patients older than 10 years of age on their satisfaction with the cosmetic outcomes of their surgeries using a validated PSAQ (Patient Assessment Questionnaire). The most significant finding of this study is that while laparoscopic pyeloplasties had the most favorable cosmetic outcome, the overall satisfaction with cosmesis was high across all

surgical approaches. Satisfaction did not differ significantly by gender or body mass index. Furthermore, although scar symptomatology was more common after open surgery, this did not affect overall PSAQ scores. These findings suggest that it is less important for the surgeon to focus on the number or locations of scars in choosing a surgical approach and rely more on which technique in their hands would result in the highest chance of clinical success. This mirrors the findings of previous studies by Barbosa² and Wang³ et al.

This study is unique in that the authors chose to exclusively survey the patients themselves rather than their parents, as previous studies have done.¹⁻³ Moreover, the authors chose to focus their study on an older age group that is more likely to be body conscious as compared to younger children who may

not yet be as aware or concerned about their body appearance. Most importantly, this study asked the patients about their actual scars rather than choosing from representative pictures and diagrams.^{1,2} These study characteristics add a real-life validity to this study. While some may question whether the study participants may have “chosen” a different incision if

given the opportunity, the fact that they were satisfied with their actual scars speaks volumes.

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REPLY BY AUTHORS

We would like to elaborate on Dr. Bayne’s comment that “results may be different if infants who had surgery were revisited as adolescents.” While this is certainly worth studying, we emphasize that cosmetic results are relevant only as long as approaches are equivalent in terms of associated risks and functional outcomes. In this respect, we believe that minimally invasive pyeloplasty (MIP) in infants should be considered cautiously.¹ Although feasible, MIP remains a major surgical endeavor in a <12-month-old, where it requires advanced skills with intracorporeal suturing in a small space. This may increase operating time, which is an issue considering the potential vulnerability of infants to the neurotoxicity of anesthetic drugs. Therefore, echoing Dr. Liu, in this age group it is absolutely paramount that one selects the procedure that can

be performed most quickly and ensures the highest chance of clinical success in their hands.

Additionally, open pyeloplasty in infants can be performed via a small incision using a muscle-sparing approach, which is far less invasive than the larger, muscle-cutting approach required in adolescents.¹ Of course, the incision will grow paralleling body growth, and the larger open incisions will grow more than the smaller MIP ones.² In order to combine the advantages of a dissection through a small incision with the ease and speed of an open anastomosis, a hybrid approach, like the 1-trocar-assisted pyeloplasty (technically difficult in adolescents due to the larger anatomy), might be the solution in this age group and should perhaps be included in a comparison.³

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