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RECOMMENDATIONS

Management of adult intestinal stomas: The 2023 French guidelines

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Summary
Aim: Digestive stoma are frequently performed. The last French guidelines have been published twenty years ago. Our aim was to update French clinical practice guidelines for the perioperative management of digestive stoma and stoma-related complications.

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Methods: A systematic literature review of French and English articles published between January 2000 and May 2022 was performed. Only digestive stoma for fecal evacuation in adults were considered. Stoma in children, urinary stoma, digestive stoma for enteral nutrition, and rare stoma (Koch, perineal) were not included.
Results: Guidelines include the surgical landmarks to create digestive stoma (ideal location, mucocutaneous anastomosis, utility of support rods, use of prophylactic mesh), the perioperative clinical practice guidelines (patient education, preoperative ostomy site marking, postoperative equipment, prescriptions, and follow-up), the management of early stoma-related complications (difficulties for nursing, high output, stoma necrosis, retraction, abscess and peristomal skin complications), and the management of late stoma-related complications (stoma prolapse, parastomal hernia, stoma stenosis, late stoma retraction). A level of evidence was assigned to each statement.
Conclusion: These guidelines will be very useful in clinical practice, and allow to delete some outdated dogma.

Introduction

Since intestinal stoma were first reported during the 17th century, perioperative treatment of stoma patients has pronouncedly progressed, particularly with the creation of stomal therapy nursing (Enterostoma Therapeuts [ET]) in the 1950s under the impetus of Norma Gill and Professor Turnbull in the United States, and through the development of associations such as the Fédération des stomisés de France and Association François Aupetit. At present in France, there are 80,000 to 130,000 ostomy patients.

Aside from urinary stomas, digestive stomas (gastrostomy and jejunostomy) are well-known, and intestinal stomas with fecal diversion likewise commonplace. They may be temporary or permanent, involving the small or the large intestine, and are terminal, lateral or double barrel.

Whatever the context, the indication, or the type of stoma, stoma-related complications can occur early (10—60%) or late (25%), and may necessitate revision surgery. What is more, a temporary stoma can become permanent.

The creation and positioning of a stoma must fulfill a number of well-defined criteria, the objectives being to reduce stoma-related complications and/or pouching of the stoma, and to increase the patient's autonomy and enhancing his/her overall quality of life. Last but not least, the psychological impact of the stoma is such that preoperative followed by regular postoperative education is indispensable.

As regards existing guidelines for overall treatment and management of patients with stomas, only one French guide on good stoma therapy practices has been published; it dates back to 2003, and is very brief [1]. American guidelines on stomal opening and closing recently appeared [2].

The objective of the present work is consequently, based on the data in the literature, to establish guidelines for good clinical regarding intestinal stomas in adults. The authors will not deal with stomas in children, urinary stomas, nutrition-related stomas (gastrostomy and jejunostomy), or rare stomas (Koch, pseudocontinent perineal). Furthermore, since indications for stoma creation vary and evolve in conjunction with progress in medical treatments and imagery, they will not be detailed in the present review. Finally, the context of short bowel syndrome (intestinal insufficiency), which entails specific complications, will not be covered.

Methods

The proposed methodology results from deliberations by the governing board of the Société nationale française de coloproctologie (SNFCP) in partnership with the Société française de chirurgie digestive (SFCD), whose approach was largely drawn from the methodology in force in the French Haute Autorité deSanté.

Three groups were constituted:

- a steering group to coordinate the work, to designate the working group, to put forward precise questions, and to ensure project advancement within the prescribed time limit;
- a working group designated by the steering group, to carry out the work while complying with the announced reverse planning, and to propose recommendations. It is indispensable that there not be any financial or intellectual conflict of interest;
- a reading group (SNFCP and SFCD members) to assess using a rating system the contents, the form and the readability of the recommendations. This group may be consulted in the absence of literature sufficient to establish a recommendation. The members of the steering group are likewise members of the reading group.

For each question, from January 2000 to May 2022 a systematic analysis of the French and English-language literature drawn from the Cochrane and Medline databases and the guidelines of the main learned societies was carried out; during this time, supplementary manual sorting (without time limit or expiration date) remained possible. As regards inclusion and exclusion criteria for the articles under consideration, the PRISMA recommendations were followed [3] Subsequent to the review of the literature, concise, graded and unambiguous responses to the questions were proposed, with the following levels of recommendation:

- grade A: scientific substantiation, established by studies with high level of evidence (level 1: high-power randomized comparative trials, meta-analyses of randomized comparative trials, decision analyses based on well-conducted studies);
- grade B: scientific presumption, provided by studies with an intermediate level of evidence (level 2: low-power randomized comparative trials, well-conducted non-randomized comparative studies, cohort studies);
- grade C: studies with lower scientific levels of evidence (levels 3 and 4: case-control studies, comparative studies with major biases, retrospective studies, case series, descriptive epidemiological studies).
- expert agreement: in the absence of a fully satisfactory study, recommendations were based on professional agreement in the working group and reading group.

When the literature was insufficient and did not allow for promulgation of a recommendation, the working group submitted its proposals to the reading group for a vote, the objective being to conclude an expert agreement.

The voting rules were as follows: rating between 1 (disagreement) and 9 (total agreement). If < 5, a free-form commentary was required; if > 90% of scores from 5 to 9, the proposal was retained; if not, the proposal was to be modified, and voted on anew.

Five parts were defined in view of covering overall treatment and management of adult patients with intestinal stoma:

- management of preoperative stoma creation;
- quality criteria for perioperative stoma creation;
- general rules for early postoperative procedure;
- management of early complications;
- management of late complications.

Management of preoperative stoma creation

What is the role of patient education?

The review of the literature led to identification of seven randomized controlled trials [4—10] (Table 1) and nine retrospective studies [11—19] reporting on preoperative education programs. The different programs highlighted a need for the intervention of a stomal therapy nurse during the education program. Previous guidelines on the subject agree that this education must be ensured by a medical and paramedical team of specialized stomal therapists [20,21].

When and how to start?

The data in the literature unanimously underline the interest of having preoperative education initiated by a specialized paramedical and medical team, prior to creation of the stoma [6—9,22]. Most of the programs point out and demonstrate that active participation of the patient's kith and kin significantly decreases the duration of learning and hospitalization. The programs cited in the literature include assistance by patient associations [7], preoperative education involving home visits by stomal therapists [6—8,22], and utilization of multimedia supports [23] and situational simulation [9]. These different studies concurrently report improvement in terms of rapid autonomy acquisition, quality of life and cost.

- Preoperative education improves quality of life and has a positive impact on the different parameters of stomal management (grade A).
- Education should be addressed to the patient and the entourage (grade A).
- This education should be ensured by a medical and paramedical team of specialized stomal therapists (grade A).

Should the future site of a stoma be preoperatively identified and marked?

Why identify and mark it out?

Three meta-analyses published in 2020 [24] and 2021 [25,26] (Table 2) assessed the impact of preoperative determination and marking of the stoma site on postoperative complications. In a Korean meta-analysis by Kim et al. including 19 prospective and retrospective observational or case-control studies, overall complications were reduced by 53% and cutaneous complications by 59% when the future stoma site was preoperatively marked [26]. On the basis of two prospective studies [27,28] and one case-control study [29], patient autonomy was deemed superior when the stoma site was preoperatively located and marked (Odds Ratio [OR] = 0,33, Confidence Interval at 95% [$CI_{95\%}$]: 0.17—0.64). In addition, the different prospective [28,30,31] and retrospective [29,32] data in the literature point to improved quality of life, whatever the assessment tool applied, when the stoma site is preoperatively marked.

Who identifies and marks the site?

Few data in the literature have assessed the impact of the type of professional proceeding to preoperative marking of the stoma site. An observational study of 140 patients with a permanent colostomy compared impact on patient quality of life according to type of professional involved: no marking vs. marking by a stomal therapy nurse vs. surgeon vs. ''non-specialized professional'' [33]. Marking by a stomal therapy nurse or a surgeon was associated with a higher ''quality-of-life'' score.

- Whether it be permanent or temporary, marking of a stoma site should be carried out preoperatively insofar as it reduces the rate of postoperative complications and improves patient quality of life (grade B).
- When possible, marking should be carried out by a stomal therapy nurse or the surgeon (grade C).

Which anatomical landmarks?

During the present analysis of the literature, no randomized controlled trial was identified specifying the ideal position of a stoma with regard to anatomical landmarks. A case series [34] concluded that to ensure that a stoma site be above the arcuate line of the posterior rectal sheath, (junction of the upper two thirds and the lower third of the sheath), its center should be at least 4 cm above a horizontal line between the anterior-superior iliac spines. What is more, visibility of the stoma was required for accessibility in so self-care. More

Table 1 Therapeutic education for the stoma patient: randomized studies.

Study	Level of evidence	Number of patients	The main objectives	The main results	When to start?	By whom?	Which program?	Impact of/on hospital discharge?
Cheung et al. [4], 2003, China	2 Grade B	C: 30 E: 29	Effect of ''progressive muscle relaxation training'' on anxiety and quality of life	Lessened anxiety and improved quality of life at 10 weeks	Postoperative D5	STO/Physician sophrologist	20 min sessions 2—3/week	NR
Chaudhri et al. [6], 2005, UK	2 Grade B (doctor and blinded private RN)	C: 21 E: 21	Time of autonomy with the stoma Hospitalization duration Unscheduled stoma therapist consultation	Significant results for all the main objectives Improved cost effectiveness	6 weeks before surgery	STO	2 preoperative home visits by a STO Postoperative: 3-4-6 weeks	Median (days): 8 vs. 10 ($P = 0.02$)
Lo et al. [5], 2010, Taiwan	2 Grade B	C: 27 E: 27	Knowledge on stomas Attitude and behavior in self-care Cost effectiveness	Group E was significantly better than group C for: — Knowledge on stomas (postoperative D7) — Attitude and behavior in self-care (D7) — Cost effectiveness	Postoperative D1	STO and family Multimedia support	Follow-up study at 7 days	NR
Zhang et al. [10], 2013, China	2 Grade B	E: 52 C: 51	Telephone follow-up evaluation of autonomy with the stoma	At one month, results of the telephone follow-up were significantly better for: — Satisfaction with care — Stoma-related complications At 3 months, the results were significantly better for: — Autonomous stoma management — Satisfaction with care — Stoma-related complications	3 months preop 1—2 days preop Postoperative follow-up by phone: 3—7 days 14—20 days 23—27 days	STO	3 months preop 1—2 days preop Postoperative telephone follow-up: 3—7 days 14—20 days 23—27 days	NS

Table 1 (*Continued*)

Study	Level of evidence	Number of patients	The main objectives	The main results	When to start?	By whom?	Which program?	Impact of/on hospital discharge?
Forsmo et al. [7], 2016, Norway	2 Grade B	E: 61 C: 61	Hospital stay duration	Significantly reduced hospital stay in the intensive education group	One or two 60-minute consultations before surgery	RN ERAS® and STO	One or two 60-minute consultations before surgery with oral and written informa-tion + linkage with patient association	Median (days): 6 vs. 9 ($P < 0.01$)
Sier et al. [8], 2017, Netherlands	2 Grade B	E: 105 C: 113	Stoma complications Quality of life	No difference in rate of complications Significantly improved quality of life	Home visits: Preoperative: 3 weeks Postoperative: 4 weeks 12 weeks Hospital visits: The day before, and 2 weeks after discharge	STO Surgeon visit at 2 weeks	Home visit D-21, D + 28 and D + 12 weeks At hospital D-1 and D + 14	NS
Koç et al. [9], 2022, Turkey	2 Grade B	Group A (preop marking, postop education): 80 Group B (idem A+ preop education): 80 Group C (idem B+ intensive prehabilita-tion): 80	Effect of intensive prehabilitation on autonomy	Significantly more rapid acquisition of autonomy Significantly less anxiety and significantly improved quality of life	45-minute consultation 48 hours before surgery with stoma pouch filled with water until the operation	STO	Follow-up the first 12 weeks after operation	NA, but more rapid and significant autonomy acquisition

STO: stoma therapist; E: experimental group; C: control group; NA: not available; NS: non-significant; RN ERAS®: Registered nurse in Enhanced Recovery After Surgery.

Table 2 Identification of future stoma site: meta-analyses.

Study	Criteria analyzed	Number of patients	Results
Hsu et al. [24], 2020, Taiwan	Prolapse Retraction Peristomal eventration Cutaneous complications	*n* = 2109	Prolapse rate not decreased Invagination rate not decreased Decreased peristomal eventration OR: 0.25 95% CI: [0.29—0.71] Decreased cutaneous complications OR: 0.29 [0.20—0.44]
Ambe et al. [25], 2022, Germany	Stoma-related complications Quality of life Dermatological complications Leaks Revision surgery	*n* = 12579	Decreased stoma-related complications: OR: 0.45, 95% CI: [0.31—0.65] Improved quality of life: SMD: 1.13 [0.38—1.88] Decreased dermatological complications OR: 0.38 95% CI: [0.29—0.50] Decreased leaks OR: 0.14 95% CI: [0.06—0.37] Decreased revision surgery OR: 0.09 95% CI: [0.02—0.49]
Kim et al. [26], 2021, South Korea	Overall stoma-related complications Cutaneous complications Peristomal eventration Prolapse Quality of life	*n* = 7729	Decreased overall stoma-related complications OR: 0.47, 95% CI [0.36—0.62] Decreased cutaneous complications OR: 0.41 95% CI: [0.32—0.52] Peristomal eventration not decreased Prolapse not decreased Improved quality of life: SMD: 1.05 [0.69—1.40]

OR: Odds Ratio; SMD: Standardized Mean Difference.

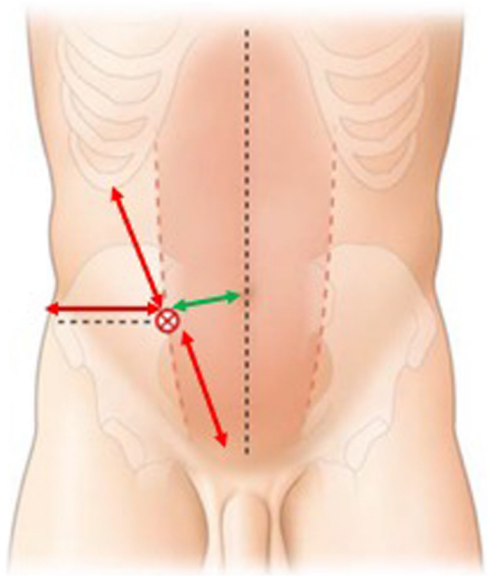

Figure 1. Anatomical landmarks for stoma positioning (Figure drawn from the Encyclopédie médicochirurgicale: techniques chirurgicales — appareil digestif — entérostomies chirurgicales 2010;40:450). Separated from bone contours (red arrows); separated from the navel (green arrow).

precisely, it should be positioned at some distance from the physiological cutaneous folds of the abdomen, the bony contours and the navel, as well as the relevant drains and scars (Fig. 1).

- Stoma marking is carried out after the patient is examined, first in a standing, then in a seated position, frontally and in profile (especially in obese individuals). The stoma site must not be situated in a fold or a hollow of the abdomen. The stoma should be positioned in a place visible to the patient (expert agreement).
- Multiple, i.e., bilateral marking is recommended (expert agreement).
- Marking is to be carried out using an indelible marker or skin-marker felt protected by transparent film such as Tegaderm©, and remain fully visible in the operating theater (expert agreement).
- Before staining (and after removal of the transparent film), the stoma site must once again be marked, and the marking must not be erased (expert agreement).
- The stomal orifice should be located 4 cm above the arched ligament (when it exists), and at least 4 cm above a horizontal line between the anterior-superior iliac spines (expert agreement).

Quality criteria for perioperative stoma creation

How to pass through the aponeurosis?

The PATRASTOM phase 1 randomized study [35] evaluated the interest and safety in elective surgery of latero-pararectal passage vs. transrectal passage of a diversion ileostomy in a population composed of 60 patients. Anal-

ysis of the available data did not highlight any significant difference in terms of peristomal eventration, otherwise known as parastomal herniation (latero-pararectal = 19% vs. transrectal = 14%, Relative Risk [RR] = 1,34; $CI_{95\%}$: 0.40—4.48; $P = 0.725$).

A Cochrane Library meta-analysis [36] did not highlight any difference in rate of peristomal eventration (RR = 1.2; $CI_{95\%}$: 0.84—1.75).

Since the meta-analysis, the long-term results (median follow-up: 3.4 years) of the PATRASTOM trial [37] have shown no difference in the eventration rate at the former ileostomy site (latero-pararectal = 13%; transrectal = 29%; $P = 0.287$).

Which aponeurosis incision?

The Stoma-const trial [38] dealt with the possible forms of aponeurosis incision for patients receiving elective end colostomy ($n = 209$). The three randomization groups were: cruciate incision, circular incision, and prophylactic aponeurosis mesh reinforcement. The peristomal eventration rates at one year were 50.8% ($n = 32$), 37.5% ($n = 24$) and 39.7% ($n = 23$) in the cruciform incision, circular incision, and mesh groups respectively. There was no significant difference in rate of peristomal eventration between the cruciform incision and the circular incision groups (RR 1.25; $CI_{95\%}$: 0.83—1.88, $P = 0.571$).

As for the ideal size of the aponeurosis opening, it has yet to be specifically assessed in any study.

Analysis of the literature does not justify recommendation of latero-pararectal or transrectal passage, or of the size and form of aponeurosis incision (grade B).

What is the most practicable trajectory at the peritoneal level?

All in all, 7 original studies [39—45] and 4 meta-analyses [46—49] were analyzed on this question; among the 7 studies, only 2 were randomized, controlled and prospective [43,44]. In their series of 128 patients, Dong et al. [43] found a significant reduction of overall peristomal complications in the extra-peritoneal as compared to the transperitoneal passage group. As for Heiying et al. [44], after a median 17-month follow-up, they reported a significantly decreased rate of peristomal eventration in the extra-peritoneal group (0 vs. 11%, $P = 0.036$). Moreover, all the original studies privilege the extra-peritoneal route as a means of preventing peristomal eventrations during colostomy. The morbidity of the procedure seems comparable to the morbidity entailed in operations via the intraperitoneal route [44]. No conclusion has been drawn on end ileostomies.

How should the loops of a lateral stoma be positioned?

Data in the literature on the positioning of lateral ileostomy loops are few and far between. A retrospective Japanese study [50] compared positioning of the afferent loop above the stoma orifice (''cranial side'', $n = 79$) to its positioning below (''caudal side'', $n = 54$) in patients operated for a colorectal pathology. Risk of occlusion at the level of the stoma orifice was significantly less frequent with the afferent loop positioned above (1.3 vs. 14.8%, $P = 0.0032$). However, this study was single-center, retrospective, with a small population consisting in non-comparable groups, and major bias concerning use of anti-adhesion film, mainly in the group with afferent loop above the stoma orifice.

- It is preferable to follow an extra-peritoneal trajectory for permanent end colostomies (grade B).
- Cranial positioning of the afferent loop above the ileostomy orifice appears favored by most surgeons (grade C).

What type of mucocutaneous anastomosis (height of protrusion, fixation to the fascia, cutaneous fixation)?

During a nationwide audit of 3070 ostomized patients in England [51], Cottam et al. reported ''problematic stoma'' incidence (change of accessory > 1/d) of 33.5%, with a short height of protrusion (< 20 mm for an ileostomy, and < 10 mm for a colostomy) as a risk factor. A single randomized study [52] including 339 patients compared mucocutaneous anastomosis techniques (intradermic suture vs. transcutaneous suture), and no significant difference was reported in terms of leaks related to the apparatus, skin irritation, quality of life or cost. During the present analysis of the literature, no study was found comparing mucocutaneous anastomosis by means of a continuous thread or separate stitches.

Even though current scientific knowledge does not justify recommendation of a thread for mucocutaneous anastomosis, it is by consensus that the experts privilege the use of absorbable material, the objective being to avoid additional treatment consisting in thread ablation (vote by membership).

- A sufficient stoma protrusion is needed as a means of preventing short-term complications (> 2 cm for an ileostomy and > 1 cm for a colostomy) (grade C).
- No mucocutaneous anastomosis technique can be recommended (expert agreement).
- No thread for mucocutaneous anastomosis can be recommended (expert agreement).

Is a support rod needed?

Since 2019, 3 meta-analyses of randomized trials have been published [53—55] (Table 3). The main meta-analysis, by Du et al., includes 4 randomized trials and 2 cohort studies [54]. All in all, 1090 patients, mainly with ileostomies ($n = 895$, 82%), were included, 549 in the support rod group, and 541 in the non-support rod group. Support rod use was found to be a risk factor for stomal necrosis (OR = 6.41, $CI_{95\%}$: 2.22—18.55, $P = 0.0006$), peristomal dermatitis (OR = 2.93, $CI_{95\%}$: 2.01—4.27, $P < 0.001$) and mucocutaneous separation (OR = 2.14, $CI_{95\%}$: 1.03—4.47, $P = 0.04$). A recently concluded, unpublished single-center French study compared 67 ileostomy patients with support rod to 63 ileostomy patients without support rod. No significant difference between the two groups was observed in terms of stomal complications. A single randomized trial specifically studied colostomies [56], with 151 patients included ($n = 75$ with support rod vs. $n = 76$ without support rod). The stomal

Table 3 Meta-analyses on the use of a support rod for lateral stomas.

Study	Type of study	Level of evidence	Number of patients	Stoma retraction Rod vs control	*P*	Secondary endpoints	*P*
Du et al. [54], 2020, China	Meta-analysis	1 Grade A	Ileostomies: 895 Colostomies: 195	OR = 0.65 (0.32—1.32)	0.23	Stomal necrosis: OR = 6.41 (2.22—18.55) Rod: 26/342 (7.6%); control: 4/319 (1.2%) Peristomal dermatitis: OR = 2.93 (2.01—4.27) R = 121/414 (29%); C = 57/409 (14%) Stomal disunion: OR = 2.14 (1.03—4.47) R = 23/335 (6.8%); C = 11/331 (3.3%)	0.0006 < 0.001 0.04
Gachabayov et al. [55], 2020, Russia	Meta-analysis	1 Grade A	392 R, *n* = 194 C, *n* = 198	OR 0.60 (0.21—1.72) R = 3.1%, C = 4.5%	NS		
Mohan et al. [53], 2018, Ireland	Meta-analysis	1 Grade A	1078 R, *n* = 561 C, *n* = 443	OR 0.7 (0.32—1.54) R = 2.3 C = 3.4%	NS	Peristomal dermatitis OR = 2.65 (1.8—3.9) R = 30%; C = 16% Stomal necrosis OR 5,6 (1,8—16,8) R = 7%, C = 1.1%	NA

R: support rod; C: Control (without support rod); NS: non-significant; NA: not available.

necrosis (10.7 vs. 1.3%; *P* = 0.018), peristomal edema (23 vs. 3.9%; *P* = 0.001) and rehospitalization (8,5 vs. 0%; *P* = 0.027) rates were significantly higher in the group with support rod than in the group without support rod.

As regards support rod use in obese patients, up until now no randomized trial has specifically dealt with any possible issues.

These recent meta-analyses confirm the contents of the 2019 Italian guidelines, which do not recommend support rod use in routine practice [21], nor do the latest American guidelines [3].

- Support rod use does not decrease stoma retraction, and it increases the risks of necrosis, mucocutaneous separation and peristomal dermatitis (grade B).
- Support rod use for lateral ileostomies is not recommended (grade A).
- Support rod use for lateral colostomies is not recommended (grade B).

Should a prophylactic/prosthetic mesh be installed during stoma creation?

All in all, 11 randomized controlled studies [57—67] and 5 meta-analyses [68—72] (Tables 4 and 5) were taken into consideration as regards the prevention of peristomal eventrations by means of prophylactic mesh. Among the 11 original studies, six found it to be beneficial [57,59,61—63,66], while the remaining five did not [58,60,64,65,67]. That much said, the studies exhibit major heterogeneity due to the different techniques of mesh installation, the different types of prosthesis used, and a lack of standardized definition and diagnosis of peristomal eventration.

In 2021, Prudhomme et al., under the aegis of the Groupe de recherche dans le cancer du rectum (GRECCAR), reported the results of a multicenter randomized controlled study comparing the positioning of a retromuscular prosthesis at a stoma site (*n* = 70) to the absence of prosthesis (*n* = 65) during creation of a definitive terminal colostomy. At two years, there was no reported difference between the two groups in

Table 4 Peristomal eventration prevention through prosthetic reinforcement (mesh patch): randomized controlled trials between patients with and without prosthetic mesh.

Study	Level of evidence	Number of patients	Main endpoint	Type of stoma	Type of prosthesis	Surgical technique	Results
Janes et al. [57], 2004, Sweden	2 Grade B	Without prosthetic mesh: 27 With prosthetic mesh: 27	Clinical PSE at 12 months	End colostomy	Polypropylene	Retromuscular Midline laparotomy	Statistically less PSE with prosthetic mesh Without mesh: 8/18 (44%) vs. With mesh: 0/16, ($P < 0.003$)
Serra Aracil et al. [63], 2009, Spain	2 Grade B	Without: 27 With: 27	Clinical and radiological PSE	End colostomy	Polypropylene	Retromuscular stomal approach	Statistically less PSE with prosthetic mesh PSE after clinical examination Without mesh: 11/27 (40.7%) vs. With mesh: 4/27 (14.8%), ($P = 0.033$) PSE after scanner Without mesh: 12/27 (44.4%) vs. With mesh: 6/27 (22.2%), ($P = 0.083$)
Lopez Cano et al. [61], 2012, Spain	2 Grade B	Without: 19 With: 17	Radiological PSE at 12 months	End colostomy	Prolene	Intraperitoneal (keyhole)	Statistically less PSE with prosthesis Without mesh 15/16 (93,8%) vs. With mesh: 9/18 (50%), ($P = 0.008$)
Fleshman et al. [58], 2014, USA	2 Grade B	Without: 55 With: 58	Clinical and radiological PSE at 24 months	Ileostomy or end colostomy	Biological (acellular porcine mesh)	Retromuscular Stomal approach	No significant difference Without mesh: 7/53 (13,2%) vs. With mesh: 5/49 (10,2%) RR = 0.94; $CI_{95\%}$ 0.51—1.75
Lambrecht et al. [59], 2015, Norway	2 Grade B	Without: 26 With: 32	Clinical PSE	End colostomy	Polypropylene	Retromuscular Midline laparotomy	Statistically less PSE with prosthesis Without mesh: 12/26 (46%) vs With mesh: 2/32 (6%), ($P < 0.001$)

Table 4 (*Continued*)

Study	Level of evidence	Number of patients	Main endpoint	Type of stoma	Type of prosthesis	Surgical technique	Results
Vierimaa et al. [65], 2015, Finland	2 Grade B	Without: 35 With: 35	Clinical and radiological PSE at 12 months	End colostomy	Polypropylene Bi-face	Intraperitoneal (keyhole)	Statistically less PSE with prosthesis Without mesh: 12/32 (32,3%) vs. With mesh: 5/35 (14.3%), ($P = 0.049$)
Brandsma et al. [66] 2016, Netherlands	2 Grade B	Without: 66 With: 67	Clinical and radiological PSE at 12 months	End colostomy	Polypropylene	Retromuscular Midline laparotomy	Statistically less PSE with prosthesis Without mesh: 16/66 (24,2%) vs. With mesh: 3/67 (4.5%), ($P = 0.0011$)
Lopez Cano et al. [62], 2016, Spain	2 Grade B	Without: 28 With: 24	Radiological PSE at 12 months	End colostomy	Polypropylene Bi-face	Intraperitoneal (modified sugarbaker)	Less PSE with prosthesis Without mesh: 18/28 (64%) vs. With mesh: 6/24 (25%), ($P = 0.005$)
Odensten et al. [64] 2019, Sweden	1 Grade A	Without: 118 With: 114	Clinical and radiological PSE at 12 months	End colostomy	Polypropylene	Retromuscular Midline laparotomy	No significant difference Without mesh: 32/107 (30%) vs. With mesh: 30/104 (29%), ($P = 0.866$)
Makarainen-Uhlback et al. [67], 2020, Finland	2 Grade B	Without: 15 With: 20	Clinical and radiological PSE at 5 years	End colostomy	Polypropylene Bi-face	Intraperitoneal (keyhole)	No significant difference Without mesh: 5/15 (33,3%) vs. With mesh: 4/20 (20%), ($P = 0,45$)
Prudhomme et al. [60], 2021, France	1 Grade A	Without: 101 With: 98	Clinical PSE at 24 months	End colostomy	Polyester	Retromuscular Stomal approach	No significant difference Without mesh: 28/101 (28%) vs. With mesh: 30/98 (31%) OR = 0.87, $CI_{95\%}$ 0.47—1.60

PSE: Peristomal eventration.

Table 5 Peristomal eventration by prosthetic reinforcement: meta-analyses.

Study	Level of evidence	Number and type of studies	Risk of bias*	Number of patients	PEP	Results
Cross et al. [69], 2016, New Zealand	1 Grade A	10 RCTs for PEP analysis	5 studies at low risk 4 studies at moderate risk 1 study at high risk	Without prosthesis: 325 With prosthesis: 324	PSE rate	PSE rate: with= 16.4%; without = 36.6% ($P < 0.001$) PSE risk reduced by 75% with prophylactic mesh
Chapman et al. [68], 2017, UK	1 Grade A	7 RCTs for PEP analysis	NA	Total number = 432	PSE rate	Significantly decreased PSE rate with prophylactic mesh (RR 0.34, $CI_{95\%}$: 0.18—0.65, $P = 0.001$)
Lopez Cano et al. [70], 2017, Spain	1 Grade A	7 RCTs for PEP analysis	7 studies at low risk	Total number = 451	PSE rate at 12 months minimum	57% decrease of PSE rate with prophylactic mesh (RR 0.43, $CI_{95\%}$: 0.26—0.71, $P = 0.0009$)
Jones et al. [71], 2018, UK	1 Grade A	10 RCTs	8 studies at moderate risk 2 studies at high risk	Total number = 771	PSE rate at 6 months minimum	Significant decrease of PSE risk with prophylactic mesh (RR 0.53, $CI_{95\%}$: 0.43—0.66)
Prudhomme et al. [72], 2021, France	1 Grade A	7 RCTs for PEP analysis	1 study at low risk 6 studies at moderate risk	Without prosthesis: 346 With prosthesis: 346	Clinical or radiological PSE rate at 1 year	No statistically significant benefit with preventive prosthesis (RR = 0.73 $CI_{95\%}$: 0.51—1.07, $P = 0.1$)

RCT: randomized controlled trial; PEP: primary endpoint; NA: not available; PSE: Peristomal eventration; RR: Relative risk; CI: Confidence interval.
* Risk of bias announced by the authors. While the meta-analyses partially cover the same studies, risk of bias is evaluated differently.

terms of peristomal eventration (31% in the prosthesis group vs. 28% in the non-prosthesis group, $P = 0.77$) [60].

Prevention of peristomal eventration (end colostomy) through installation of a retromuscular prosthesis is not recommended (grade A).

General rules for early postoperative procedure

What type of material should be used in the immediate aftermath of surgery?

As of now, there exist no data with a high level of evidence justifying recommendation of the material to be used right after an operation.

What are the conditions propitious to hospital discharge?

Dehydration after stoma manufacture is a frequent complication leading to rehospitalization of 1 to 42% of patients during the first 30 postoperative days [73,74]. As reported in the recent review of the literature by Du et al., this complication is twice as frequent after ileostomy than after colostomy (OR = 0.52, $CI_{95\%}$: 0.3—0.88) [75].

Should biological examination be systematically prescribed?

As of now there exists no study with high level of evidence that would justify recommendation of a systematic prescription for biological examination prior to hospital discharge.

A case-control study by Munshi et al. in the framework of a care protocol recommending biological examination twice a week for eight postoperative weeks following defunctioning loop ileostomy reported no significant difference in terms of overall dehydration and hospital readmission; on the other hand, a lower rate of symptomatic dehydration was observed in the prtocol group (11 vs. 29%, $P < 0.05$) [76].

Which hygienic and dietary rules should be applied postoperatively?

In the literature, there exists no argument justifying recommendation of a specific and systematic dietary regimen subsequent to stoma insertion. That said, following an ileostomy, clinical practice guidelines based on expert agreement recommend one liter/day of hydration. In the Villa France study, fruits and (primarily raw) vegetables were reported as contributors to increased stoma output [77]. A recent randomized study compared 39 patients with ileostomy (after proctectomy) who were administered an oral rehydration solution (ORS) for 40 days following hospital discharge to 41 patients with ileostomy (after proctectomy) who were not administered an ORS. ORS consumption was significantly associated with a decreased rate of rehospitalization due to excessive stoma output (ESO) and ionic disturbances [78]. This study underscored the importance of limiting hypo or iso-osmolar water intake and of favoring oral isotonic drinks, the objective being to limit the sodium losses entailed by stomas.

In clinical practice, Saint Yorre® Vichy water presenting salt concentration of 0.38 g/L or 74 mmol/L in the form of sodium bicarbonate is routinely administered to compensate for stoma-related sodium losses ranging from 85 to 180 mmol/L/D [78].

What type of appliance should be provided at discharge?

There exists no specific study on this question. In a home setting, an appliance must be adapted to the patient, and in compliance with the following criteria: effective (no leakage, no odor, skin-protective), comfortable (no discomfort, avoidance of overly frequent care, maximum respect for patient autonomy), discreet (neither visible nor audible). Different appliances can be chosen (one piece, two interlocking or adhesive pieces, flexible, convex...) once the patient has returned home.

- Utilization of a transparent and drainable pouch is advisable immediately after the operation (expert agreement).
- For patients with an ileostomy and at risk of dehydration, the working group recommends a biological examination with assay of creatininemia and blood ionization two times a week until attainment of normal biological examination results and stoma output < 1 L/24 h (expert agreement).
- No systematic specific dietary regimen following stoma manufacture can be recommended (expert agreement).
- Lessened consumption of food found by the patient to increase stoma output or to modify stoma thickness is recommended (expert agreement).
- Limited to 1/L and associated with sodium-rich hydration (60—90 mmol/L), oral hydration by hypo- or hypertonic solutes (tea, coffee, fruit juice, soda) is recommended during the days and weeks subsequent to surgery (grade B).
- The apparatus should be compatible with the stoma and adapted to the patient (expert agreement).

What is the most optimized follow-up for ostomy patients?

The main prospective trials on postoperative follow-up of ostomy patients show that monitoring is ensured by stoma therapists.

The scheduling proposed in the different studies and recommendations is variable. Follow-up is initiated by stoma therapists during hospitalization and incorporated into patient education programs. Initial additional follow-up is carried out on at least the third day after hospital discharge [79] and at most three weeks later [6]. The patient follow-up modalities proposed in the literature are multiple: teleconsulting [79—82], mobile application, multimedia support placed at patients' disposal [23] (Table 6).

Table 6 Hospitalization/return home relays: randomized trials.

Study	Level of evidence	Number of patients	The main objectives	The main results	When to start?	By whom?	Which program?	By what means?
Lo et al. [23], 2011, Taiwan	2 Grade B	E: 46 C: 56	Effectiveness of multimedia support for postoperative follow-up/patient education	Significantly improved patient autonomy (KSCS, ASCS, BSCS scores)	Postoperative	STO	Information program by caregiving team Multimedia complement	Video + illustrations
Harrison et al. [79], 2011, Australia	1 Grade A	E: 39 C: 36	Effectiveness of telephone follow-up by an RN (CONNECT trials) Quality of life at 1, 3, 6 months	No significantly improved quality of life No difference in solicitation of stoma therapy teams	NA	STO	Telephone consultation After discharge: D3 and D10, M1, M3, M6	Telephone
Zhang et al. [80], 2013, China	2 Grade B	E: 60 C: 59	Quality of life (stoma-QOL, CD_RISC), autonomy management (ESCA)	Significant improvement in the study from 3 months and over time	Immediately postoperative	STO	Follow-up and interaction by mobile application	Telephone Mobile application WeChat
Wang et al. [81], 2018, China	2 Grade B	E: 100 C: 103	Effectiveness of follow-up using mobile application on ''psychosocial adaptation'' OAI-23 score	Improved quality of life (OAI-23 score) at 6 months	From hospital discharge	STO	Follow-up and interaction by mobile application	Mobile application
Xia et al. [82], 2019, China	2 Grade B	E: 81 C: 74	Quality of life (stoma-QOL), autonomy management, stoma anxiety (STAI)	Improvement according to judgment criteria from 1 month (autonomy) and from 3 months (anxiety)	Immediately postoperative	STO	Follow-up and interaction by mobile application	Mobile application WeChat, blog

ALS: average length of stay; E: experimental group; C: control group; RN: registered nurse; NA: not available; STO: stoma therapist.

- Postoperative follow-up provided by a medical and paramedical team is recommended; it shall include consultations with a stoma therapist (grade A).
- Follow-up must be initiated immediately after the operation and be continued subsequent to patient discharge (grade A).

Management of early complications

Difficulties with appliances

Difficulties with appliances are reported by 46% of ostomy patients, altering their quality of life [83,84]. In the literature, the causes of difficulties with appliances encompass: appliance insertion (baseplate-stoma incongruity, poor baseplate application, inadequate stoma maintenance, overfilled collection pouches), the apparatus itself (defective or unsuitable material), the form of the stoma and/or the peristomal area [85].

Treatment

Management of the difficulties with appliances attempts to address the different causes identified during the questioning and examination of the patient (excessive stomal output, the apparatus itself, adaptation of the equipment...). In a prospective series of 284 colostomy and ileostomy patients, the frequency of baseplate change due to fecal leak decreased by 78 and 88% to 3 and 8% respectively, two months after the introduction of a moldable baseplate, also known as a skin barrier [86].

A randomized crossover study compared a convex stoma appliance with a flat stoma appliance in 38 patients and reported significantly reduced leakage with the convex baseplate [87]. In the opinion of stoma therapists, maintenance of the stoma by a convex ostomy belt can be proposed when leaks persist in invaginated stomas [88].

- Whatever the early stoma complication (except for abscesses), when treatment failure occurs and provided that the stoma is temporary, restoration of intestinal continuity is the simplest surgical option.
- In ostomy patients experiencing difficulties with appliances, it is recommended to review with the patient the techniques employed and, more generally, the ostomy care administered (expert agreement).
- The conventional flat baseplate can be replaced by a moldable or convex baseplate, whatever the conformation of the stoma (grade B).
- An ostomy belt can be added to the baseplate in the case of insufficient efficacy (expert agreement).

Excessive stoma output

Stoma output considered as normal ranges from 600 mL to 1,2 L in 24 hours. There is no strict definition of excessive stoma output, which ranges from 1.5 to 2 L of digestive fluid loss in 24 hours. It occurs in approximately 30% of ileostomies [89] and can be responsible for prolonged hospitalization [77] or readmission in 17% of cases [90], as well as various nutritional complications. Some etiologies are known to entail increased stoma output; causes at an early stage are infectious (*Clostridium difficile*, Salmonella) or drug-related (gastro-kinetic), and causes at a later stage are mechanical (short gut, stenosis, fistula...).

Treatment

Decreased ingestion of hypotonic fluids is of proven effectiveness in treatment of excessive stoma output. In a review of the literature, Nightingale [91] confirmed the importance of reduced ingestion (from 0.5 mL to 1 L/24 h) of hypotonic fluids (water, tea, coffee, fruit juice, alcohol), and stated that the patient should not be encouraged to drink as much as possible to compensate for stomal losses. The authors also confirmed the advisability of regular consumption, by small quantities (1 L or more) of an ORS [92], and in the 1990s, Beaugerie et al. demonstrated that added dietary sodium, the objective being to reach per os concentration of 100 mmol/L, could be recommended [93].

If the restriction of hypotonic fluids associated with ORS supplementation turns out to be insufficient, medication should be introduced. A recent randomized double-blind study on a small population ($n = 12$) concluded that loperamide (Imodium) can reduce pancreatic biliary secretions by 20% [94]. According to the 2006 guidelines of the British Society of Gastroenterology, 4 to 16 mg a day is an optimal dose [95]. That said, a risk of prolonged QT interval and *torsade de pointe* was underlined in 2017 by the UK Medicines and Healthcare products Regulatory Agency (MHTA). An electrocardiogram (ECG) test is now recommended prior to administration of strong doses of loperamide [96]. The association of loperamide and codeine has been known since the 1980s; according to three studies [94,95,97], the former may potentiate the latter. As for codeine phosphate, it can be administered at a maximum dose of 60 mg a day [98,99]; however, loperamide entails fewer side effects.

When these different measures fail to contain excessive stomal output, the most intuitive option consists in the restoration of intestinal continuity; as an alternative, specifically targeted treatment in a reference center for the management of severe intestinal failure can be proposed and other approaches considered, one of them being chyme reinfusion; it bears mentioning that since 2023 in France, treatments for intestinal failure with excessive stoma output are potentially refundable.

- The first step in management of excessive stoma output consists in search for an etiology lending itself to specific treatment (expert agreement).
- First-line treatment of excessive stoma output is based on compliance with adapted hygienic and dietetic rules and recommendations: per os hypotonic fluid intake limited to 500 mL to 1 L a day, high-sodium fat-rich dietary regimen, per os or intravenous saline compensation by means of rehydration solution, parenteral nutrition (if necessary) and constant nutrition monitoring (grade A).
- In the framework of excessive stoma output, initial introduction of an antidiarrheal (loperamide) is recommended (grade B).
- Prior to introduction of high-dose loperamide, ECG testing is called for (grade A).

Stoma necrosis

In prospective series, stomal necrosis has been reported in 3 to 7% of ostomy patients, and is more frequently observed after colostomy than following ileostomy [83,100].

In terms of order of severity, localized necrosis at the edges of the stoma, partial/superficial and complete/deep necrosis have been distinguished from one another [101]. In-depth extension of stomal necrosis can be endoscopically evaluated [102—104].

Treatment

According to an expert audit, treatment of localized and/or superficial stomal necrosis is based on local procedures, with debridement of the necrosis and use of transparent collection pouches to facilitate surveillance of the lesions [88]. That said, deep and extended subaponeurotic necroses necessitate revision surgery involving resection of the necrotized segment and creation of another stoma [102,103].

- Stomal necrosis of limited extent is treated by debridement of the necrosis and by equipping the stoma appliance with a transparent collection pouch to monitor progression of the necrosis. The in-depth extension of a necrosis is assessed endoscopically (grade C).
- Resection of a necrotized segment and creation of a new stoma are indicated in cases of complete and extended necrosis of the subaponeurotic intestinal segment (expert agreement).

Stomal disinsertion

Stomal disinsertion is defined as loss of contact between the gastrointestinal tract and the peristomal skin. It occurs in 15 to 25% of patients and can result from stomal necrosis and/or excessive traction force on the stoma itself [83,100].

Treatment

According to a practice report established by 281 stoma therapists, non-profound disinsertion should be treated by regular cleaning of the uncovered area and by the application of powder to absorb local seepage and facilitate baseplate adherence. More deep-seated disunion can be remedied by alginate dressing or hydrofiber before being covered by stoma barrier rings [88]. As is the case with stomal necrosis, surgical revision of the stoma is to be considered when the disinsertion is circumferential and when the digestive mucosa has retracted backwards on the aponeurotic plane [105].

- Stomal disinsertion treatment is based on local care, with application of powder on superficial disunion and utilization of alginate or hydrofiber on more deep-seated disinsertion. Disinserted areas can be covered by stomal baseplate or stoma barrier rings (expert agreement).
- Deep-seated circumferential disinsertion with digestive mucosa retracted backwards on the aponeurotic plane should trigger discussion on redo stoma surgery (expert agreement).

Peristomal abscess

Peristomal abscess immediately after surgery is relatively rare (3% of patients in prospective series) [83]. It may be useful to carry out an abdominal scan in the event of suspected abscess in order to define its contours and possible extension in the soft tissues and the intra-abdominal subaponeurotic area, the objective being to orient treatment.

Treatment

Peristomal abscess treatment is based on surgical draining of the cavity of the abscess at the level of the mucocutaneous junction or exterior to the fixation area of the appliance [105]. The role of antibiotics as complements to surgical drainage of the abscess has not been analyzed in the literature and depends on the systemic repercussions of the sepsis and on underlying immunosuppression.

Treatment of a peristomal abscess is premised on itssurgical drainage, either at the mucocutaneous junction of the stoma, or exterior to the apparatus in use. In the event of deep-seated abscess, surgical procedure can be guided by preoperative abdominal scan (expert agreement).

Peristomal skin lesions

Peristomal skin lesions represent the most frequent complications in temporary or permanent stoma patients, with prevalence ranging from 10 to 73% [106—115]. These lesions can have a major impact on quality of life [116]. The data in the literature are limited to series, most of which are retrospective [110,113,115], and to one randomized controlled trial involving a small population [117]. The major recognized risk factors for peristomal skin lesions [110] are: ileostomy [112], overweight and obesity, leaks, unsuitable or malfunctioning appliance [106], smoking, malnutrition [115], invaginated stoma [106,118], pre-existing dermatosis [108], autoimmune disease, chronic inflammatory bowel disease (CIBD), and a context of immunosuppression.

Among the different peristomal skin lesions, irritant peristomal dermatitis is the most frequent, while pyoderma gangrenosum is the most severe. Irritant peristomal dermatitis affects up to more than 50% of patients with a stoma and is characterized by erythema, erosions, granulation tissue and/or ulcerations. Peristomal pyoderma gangrenosum (15% of pyoderma gangrenosum) is a potentially severe complication, generally appearing in patients with CIBD or an active autoimmune disease [119]. This complication can ensue several years after stoma manufacture. It is a non-infectious neutrophilic form of dermatitis, secondary to an abnormal scarring process possibly triggered by a minor traumatic event. The skin lesion can initially take on the form of a nodule or a hemorrhagic gas bubble or blister, before evolving into an acutely painful superficial or deep-seated necrotizing ulceration with irregular red to purple (purpuric) edges progressing rapidly, and purulent or hemorrhagic ooze (exudate). Clinical diagnosis is confirmed by microbiological or histological sampling.

Treatment

Treatment of irritant peristomal dermatitis consists in identification and correction of a contributing factor, followed by adapted local care using hydrocolloid, moisture-absorbing powder preserving the impermeability of the stoma apparatus. In the event of persistent dermatitis, local corticosteroid treatment may be considered. That said, the absence of robust data precludes the formulation of guidelines pertaining to type of cutaneous barrier or stoma appliance scheme.

Treatment of pyoderma gangrenosum is multimodal and multidisciplinary, associating a dermatologist, a stomal therapy nurse, a gastroenterologist and a digestive surgeon [120]. It is necessary to search for and/or correct a triggering factor, a superinfection, to relieve the pain and to propose specific treatment (topical corticosteroids, tacrolimus 0.3%, or systemic therapies: corticoids, immunosuppressors); stoma closure is another eventuality.

- Special attention should be paid to the patient at risk of peristomal skin lesions (ileostomy, excessive output, obesity, smoking, preexisting dermatosis) (grade C).
- Any treatment of a peristomal skin lesion should involve a specialized nurse and a surgeon's advice (grade C).
- Any refractory or rapidly progressive lesion should be biopsied and treated with the help of a dermatologist (grade C).
- Treatment of irritant peristomal dermatitis consists in the identification and correction of a contributing factor, and in application of adapted local care using hydrocolloid treatment preserving the impermeability of the stoma appliance (expert agreement).
- In the event of persistent dermatitis, a local corticosteroid treatment can be considered, with rapidly drying (spray) forms to be preferred to creams and lotions, which may jeopardize skin adhesion to the stoma appliance (expert agreement).
- The management of pyoderma gangrenosum is multidisciplinary, including stomal therapy nurse, dermatologist, digestive surgeon and gastroenterologist (expert agreement).

Management of later complications

Stoma prolapse

Stoma prolapse is defined as intussusception of the intestine through a stoma orifice. It is a late complication of intestinal stomas, it occurs in 2–3% of ileostomies and in 2–26% of colostomies [121]. The main known risk factors are heightened intra-abdominal pressure (obesity, chronic obstructive pulmonary disease), malposition in a cutaneous fold, disproportionately large stoma orifice, and high intestinal motility. This late complication has a major impact on patients' quality of life and bodily integrity. The most frequently encountered symptoms are irritation of the neighboring skin, appliance problems, and mucosal ulceration with bleeding on contact. Stoma prolapse is divided into two categories, permanent and intermittent (occurring during abdominal pressure increase) [122].

Treatment

Management of simple stoma prolapse can be conservative/medical, or surgical in the event of complication.

Conservative (medical) treatment is carried out collaboratively with ostomy care by a stoma therapist and is based on manual reduction of the prolapse. If the latter fails, it is possible to apply sugar, cold compresses or mannitol-soaked compresses, the common objective being to shrink the stomal prolapse by osmotic pressure [123–126].

Surgical treatment is indicated when medical treatment fails or a complication has occurred. If the stoma is temporary, the simplest and most intuitive approach consists in proceeding to early closure [121]. Surgical repair can then be considered and surgical techniques, many of them derived from treatment of rectal descent and prolapse, have been reported in the literature. Firstly, the modified Delorme procedure consists in excision of the inner lining from the surface of the prolapsing bowel, followed by myorrhaphy or plication [127,128]. Secondly, the modified Altemeier procedure [129] consists in total resection of the prolapsing segment, followed by anastomosis with sutures using absorbable sutures [130]. Thirdly and more recently, the Stapler repair method is based on vertical division, using mechanical fastener clips to section off the two sides of the stomal prolapse, followed by horizontal division using a different mechanical fastener clip [131,132]. While these different methods are associated with low morbidity and high success rates, up until now they seem to have been limited to retrospective series with small populations without prolonged follow-up [127–132].

- In the event of failed manual reduction without complication, it remains possible to apply sugar and cold or mannitol-soaked compresses (grade C).
- In case of complicated temporary stoma, stoma closure is the most intuitive option (expert agreement).
- Given the absence of robust data in the literature, in case of indication for surgical stomal repair, it is difficult to justify choice of one surgical technique rather than another. Due to the vagaries of postoperative recovery, elective repair techniques may be privileged, and the Stapler repair technique consumes less operating time than the others (grade C).

Peristomal eventration, otherwise known as incisional hernia

Defined by the European Hernia Society as the protrusion of abdominal contents through incisional hernia resulting from repair surgery, peristomal eventration is one of the most frequent late-occurring stoma complications. Incidence is estimated at more than 30% during the first year after stoma creation, rising to more than 40% the second year and more than 50% during a period exceeding two years [133]. Incidence of peristomal eventration depends on type of stoma, with prevalence for end colostomies being the highest, ranging from 4 to 48% [134]. Peristomal eventration exposes the patient to a risk of mechanical complications (stran-

gling, occlusive syndrome) entailing altered quality of life secondary to pain, sensations of heaviness, appliance difficulties, and esthetic discomfort.

The diagnosis for peristomal eventration is based on clinical examination (sensitivity 66 to 94%) [133] and/or imaging study represented in routine practice by abdominal CT scan without injection using Valsalva maneuver, which enhances visualization of the eventrations in 50% of cases, while unmasking them in 20% [135,136]. In a recent meta-analysis on the means of detection and diagnosis of peristomal eventration including 29 studies and more than 2500 patients, 79% of the studies reported increased incidence of peristomal eventration in patients having received abdominopelvic scan [137].

- While clinical examination shows excellent specificity (100% — sensitivity 66—94%) for the diagnosis of peristomal eventration, computerized abdominal tomography is more sensitive (grade C).
- Abdominopelvic scan with Valsalva maneuver improves diagnostic performance in peristomal eventration (grade C).

Treatment

A non-operative strategy (abdominal girdle, baseplate fixation belt, elastic supports [138,139]) is indicated in the event of non-symptomatic or pauci-symptomatic eventration. Few data comparing non-operative treatment and surgery are available in the literature. In a retrospective multicenter study involving 80 patients, Kroese et al. compared the outcomes of 38 patients having undergone non-operative treatment (48%) and 42 patients having undergone surgery (53%). Among the 38 non-operated patients (46-month follow-up), 21% finally underwent surgery, which for only one patient (3%) was due to strangled eventration. Redo surgery after non-operative treatment was not associated with an excessive risk of postoperative morbidity or eventration recurrence, while the recurrence rate in the original ''surgery'' group was 55% [140]. As for emergency rather than elective surgery, it was associated with heightened risk of postoperative morbidity, especially in patients over 70 years old [141,142].

Optimal treatment of peristomal eventration is based on restoration of intestinal continuity. When this is not feasible, several surgical options may be open: incisional hernia repair without interposition of prosthetic mesh (simple suture, stomal transposition) and elective surgery with interposition of prosthetic mesh, by laparotomy or via a minimally invasive approach with different interposition techniques. However, there exist very few data in the literature from randomized controlled trials on treatment and management, aside from prevention, of peristomal eventration.

Simple suture consisting in the tensing of aponeurotic muscle tissues by elective approach is associated with high risk of recurrence (46 to 100%) [134]. It is nevertheless the primary strategy in case of strangulated hernia aggravated by contamination of the surgical site. In a meta-analysis of 30 studies comparing suture repair to mesh (prosthetic) repair, suture repair was associated with heightened risk of recurrence (OR 8.9 $CI_{95\%}$: 5.2—5.1; $P < 0.0001$), and with abdominal wall abscess (OR 4 $CI_{95\%}$: 1.7—9.5; $P = 0.02$) [143].

- In asymptomatic patients with comorbidities who are not wishing to undergo surgery, a non-operative strategy may be considered (grade B).
- While the risk of complications such as strangled hernia appears quite low, it tends to yield higher morbimortality than programmed surgical treatment (grade B).
- For patients not having initially undergone surgery, secondary surgery seems to yield results in terms of morbidity and recurrence equivalent to those observed in immediately operated patients (grade B).
- In an elective situation, due to heightened risk of recurrence, simple suture is not indicated (grade B).
- Simple suture can be considered in the event of limited defect, surgical site contamination or for comorbid patients at high surgical risk (grade C).
- Stomal relocation should be contralateral (grade C).
- Stomal relocation exposes the ostomy patient to heightened risk of recurrence associated with risk of eventration of the previous stomal orifice (grade C).
- Stomal relocation should not be considered as first-line treatment in surgical management strategy (expert agreement).

Stoma relocation is classically aimed at moving a stoma from the contralateral side of the abdomen. Heightened recurrence has been reported in homolateral as an alternative to contralateral relocation [144]. In their series, Rubin et al. observed peristomal eventration coming to 33% after stoma relocation vs. 76% after simple suture ($P < 0.01$), with a heightened risk of short and long-term complications (88 vs. 50%, $P < 0.05$), and risk of eventration (incisional hernia) on the previous stoma orifice was as high as 52% [145].

Surgical treatment of peristomal eventration (incisional hernia) with interposition of a prosthesis (mesh) is the recommended technique in elective situations [133,146]; however, this recommendation is mainly based on small-population retrospective series [143]. The mesh may be placed either in front of the anterior aponeurosis of the abdominal muscles (onlay), in a retromuscular position (sublay), or in an intraperitoneal position. As of now, there exists no randomized trial comparing these different types of positioning. In the literature, the onlay position is associated with recurrence rates ranging from 14.8 to 18.6% and with prosthesis-related infection varying from 1.9 to 2.6% [143,147], while retromuscular interposition is associated with recurrence rates of 6.9 to 7.9% [143,147].

Non-absorbable synthetic protheses (polyester, polypropylene, polytetrafluoroethylene) can be distinguished from absorbable or biological meshes. Little information comparing these different types of mesh is available in the literature. As regards biological meshes, a meta-analysis reported the outcomes in four retrospective studies including 57 patients: 15.7% experienced recurrence and 26.2% underwent parietal complications, but without mortality or mesh infection. However, the authors' conclusion was that given the comparable outcomes in terms of recurrence for synthetic meshes, and taking into account the extra costs entailed by biological meshes, the latter could not be recommended [148].

In any event, the most favorable outcomes have been associated with intra-abdominal synthetic meshes, for which two different surgical techniques may be considered: the

Table 7 Synthesis of the 10 main recommendations for adult intestinal stomas.

Are recommended	Are not recommended
1. Therapeutic education — Preoperative — Patient and entourage — Specialized medical and paramedical team	
2. Stoma site identification — Preoperative — By surgeon or stoma therapist	
3. Extra-peritoneal trajectory for end colostomy	
4. Stoma protrusion — > 1 cm for colostomies — > 2 cm for ileostomies	
	5. Utilization of a support rod for lateral stomas
	6. Retromuscular prophylactic mesh
7. Prolonged postoperative follow-up with stoma therapist	
8. Treatment of excessive stoma output — Hygienic and dietary rules — Limitation of hypotonic fluid intake (0.5 and 1 L) — High sodium, fat-rich regimen — Per os —IV saline compensation — Dietetic follow-up — Antidiarrheal agent (loperamide), subsequent to ECG	
	9. First-line simple suture et stoma relocation in elective situation of peristomal eventration
10. Peristomal eventration: prosthetic repair by laparoscopy, according to the Sugarbaker technique	

Sugarbaker (digestive tube with spiral flow path covered by the mesh) or the Keyhole (digestive tube surrounded by the mesh with a direct flow path, like an inverted top hat). The data in the literature comparing these techniques have been almost exclusively derived from retrospective series. In their meta-analysis, DeAsis et al. discussed the results reported in 15 articles, which encompassed 469 patients surgically treated by laparoscopic parastomal hernia repair ($n = 191$ Sugarbaker vs. $n = 231$ Keyhole). Recurrence rate in the Sugarbaker group was 10.2%, as opposed to 27.9% in the Keyhole group [149]. In a different meta-analysis, Hansson et al. likewise observed that in comparison with the Sugarbaker group, the Keyhole technique was significantly associated with increased risk of recurrence (OR 2.3 $CI_{95\%}$: 1.2—4.6; $P = 0.0016$) [143].

As regards surgical approach, the English and American learned societies have adjudicated on the possible equivalence of laparoscopic and open surgery [133,146]. More recent findings have shown the laparoscopic approach to be associated with decreased operating time, duration of hospital stay, and postoperative morbidity [150,151].

- Use of a biological mesh entails added costs (grade C).
- Comparative data do not suffice to determine the superiority of one type of synthetic mesh over another (grade C).
- Installation of an onlay mesh seems associated with heightened recurrence rates, and should not be recommended (grade C).
- The recurrence rates of retromuscular and intra-abdominal prosthesis positioning seem equivalent (grade C).
- Surgical treatment of peristomal eventrations (incisional hernia) by laparoscopic surgery is a reliable technique associated with moderate morbidity (grade B).
- The Sugarbaker laparoscopic technique seems associated with lower risk of recurrence than the Keyhole technique (grade C).

Stoma orifice stenosis

An intestinal stoma insertion orifice gradually shrinks. There is no definition in the literature of a threshold diameter of a colostomy or an ileostomy, beneath which stenosis would be diagnosed. In clinical practice, however, stoma stenosis is defined by the appearance of various symptoms: debilitating noises occasioned by the discharge of gases or stools exterior to the stoma, intestinal occlusion and spontaneous closure of the stoma orifice. In the literature, prevalence ranges from 1 to 15% [39,152—154].

Treatment

Different strategies have been reported in the literature: therapeutic abstention in the event of pauci-stenosis or non-symptomatic stenosis, stomal dilation with Hegar dilator, W-plasty or Z-plasty surgical reconstruction [155,156], or a ''radical'' strategy consisting in a stomal reoperation. In the literature, no comparative data are available.

It is not possible to recommend a therapeutic strategy for stomal stenosis, the reason being that no data comparing the effectiveness and risks of each option are currently available (expert agreement).

Stomal invagination

A stoma is considered as invaginated when an edge of the bowel segment used in stoma creation is located under the skin. In the literature, the reported frequency of this complication ranges from 1 to 9% [83,157,158].

Treatment

Different therapeutic strategies have been reported in the literature, ranging from conservative treatment based on specific convex models of stoma baseplate to complete surgical reconstruction of the stoma. No comparative data are available in the literature.

- Convex stoma baseplates may foster tolerance of stomal invagination, thereby obviating the need for surgical reconstruction (expert agreement).
- While radical reconstruction of the stoma may be a treatment for invagination, as of now no relevant data are to be found in the literature (expert agreement).

Conclusions

In conclusion, these French guidelines represent an updating of the previous version; through analysis of the relevant scientific literature, a number of unfounded dogmas have been refuted. Our recommendations are largely in agreement with the current American guidelines. We have synthesized our ten main recommendations to remember in Table 7.

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Disclosure of interest

The authors declare that they have no competing interest.

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