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Classification and surgical treatment of incisional hernia

Results of an experts' meeting

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Abstract *Background:* The treatment of incisional hernia (IH) is a current problem in modern surgery. Many important aspects of incisional hernia surgery are yet to be answered, especially the choice of surgical technique and its adaptation to the individual patient. The aim of this experts' meeting was to resolve some current questions in incisional hernia surgery and to organise an international hernia register. *Methods:* An international panel of ten experts met under the auspices of the European Hernia Society (GREPA) to investigate the classification and therapeutic alternatives for incisional hernia. Prior to the conference, all experts were asked to submit their arguments in the form of published results. All papers received were weighted according to their scientific quality and relevance. The information from this correspondence was used as a basis for panel discussion. The personal experiences of the participants and other aspects of individualised therapy were also considered. *Results:* The expert panel suggested a new classification of incisional hernia based on localisation, size, recurrences and symptoms. All experts agreed that the fascia duplication and the fascia adaptation should only be used for small incisional hernias. Fascia duplication is of value only in the horizontal direction. The technical details and the pros and cons of each procedure were discussed for prosthetic implantation using onlay and sublay techniques and the technique of autodermal hernioplasty. *Conclusions:* The management of incisional hernia is currently not standardised. In order to answer relevant questions of incisional hernia surgery, an international hernia register should be established.

Keywords Incisional hernia · Classification · Surgical techniques

Introduction

Despite the increasing progress of modern surgery, the optimum surgical treatment of incisional hernia is still an unanswered problem [17]. Although an analysis of the literature yields a huge amount of publications on this topic, a standardised access to incisional hernia therapy is still lacking. At present, different operative techniques of hernioplasty are used, such as simple closure, Mayo-duplication, prosthetic-implantation in the onlay and sublay techniques, autodermal plasty as well as laparoscopic procedures. The choice of surgical technique is mainly based on the individual surgeon's preference and the financial background of the hospital [12, 20, 22, 30, 31, 43]. In the absence of valid scientific data, there is no general agreement on definition and treatment of incisional hernia.

Current scientific discussions are targeted towards a more individually oriented treatment. Even in large hospitals, however, the number of operations is often too small for a meaningful comparison of different surgical techniques. With respect to the development of evidence-based surgical practice and practice guidelines, a national or even international co-operation is therefore required. As a first step towards such co-operation, an experts' meeting was organised to discuss of current questions of incisional hernia surgery. The organisation of an international hernia register is considered as a future perspective.

Methods

In preparation of the "20th International Congress of the European Hernia Society" – GREPA – it was decided to carry out an experts' meeting concerning the current questions of incisional hernia surgery. The group in Cologne was asked to organise this meeting. Ten well-known international experts were nominated by the scientific committee of the GREPA. The choice was based on each of the expert's clinical experience and scientific activities in incisional hernia surgery.

Three months before the congress, the chosen experts were provided with a prepared plan of the discussion and an overview of the literature. The topics of discussion were restricted to the treatment of already existing hernias. Measures of preventing hernia, for example using different suture techniques, were not discussed. The literature search aimed at identifying clinical trials on incisional hernia surgery. With regard to study design, we considered prospective and retrospective, controlled and uncontrolled trials to be acceptable, since randomised trials are extremely rare in this field. The Medline database was searched again after the meeting was over, in order to stay abreast of new clinical information.

The meeting itself took place on 18 June 1998, in Cologne. We combined a consensus method [40] and a nominal group technique [24] to reach decisions on a prespecified topic. The complete discussion was documented on tape. After discussing and voting on each topic, a preliminary statement for each question was formulated. Because of time shortage, the last three questions had to be omitted from the discussion. After the congress, the experts were asked for a written personal statement on these questions. After the final modifications had been made according to the experts' comments, the full text was sent to the experts for a final correction. The text was approved by all participating experts and should be regarded as a combination of an evidence-based and opinion-based process.

Results

Question 1: The definition of the incisional hernia

The following definition was proposed: "Any abdominal wall gap with or without bulge in the area of a postoperative scar perceptible or palpable by clinical examination or imaging".

Question 2: The classification of incisional hernias

Incisional hernias can be classified according to their localisation, size, recurrence, reducibility and symptoms. The following classification schemes are being used.

According to localisation (modified Chevrel) [14]

1. Vertical
   - 1.1. Midline above or below umbilicus
   - 1.2. Midline including umbilicus right or left
   - 1.3. Paramedian right or left
2. Transversal
   - 2.1. Above or below umbilicus right or left
   - 2.2. Crossed midline or not
3. Oblique
   - 3.1. Above or below umbilicus right or left
4. Combined (midline + oblique; midline + parastomal; etc)

According to size

1. Small (<5 cm in width or length)
2. Medium (5–10 cm in width or length)
3. Large (>10 cm in width or length)

The definition of the hernia-size must differentiate between the "false" and the "real" fascial gap. The "false" fascial gap is the defect of the scar-tissue that embraces the frontal abdominal wall, which does not include muscular aponeurotic structures and does not have a real suture force at it disposal. The "real" fascial gap is defined as the distance in between the complete muscular aponeurotic structure that embraces the defect of the frontal

abdominal wall. According to the final definition of the hernia-size, the "real" fascial gap should be measured, even though not every incisional hernia has a "real" and a "false" fascial gap.

According to recurrence

1. Primary incisional hernia
2. Recurrence of an incisional hernia (1., 2., 3., etc. with type of hernioplasty: adaptation, Mayo-duplication, prosthetic implantation, autodermal etc.)

According to the situation at the hernia gate

1. Reducible with or without obstruction
2. Irreducible with or without obstruction

According to symptoms

1. Asymptomatic
2. Symptomatic

Question 3: Should the 'simple' reconstruction of incisional hernias (adaptation of fascia/ Mayo-procedure) still be performed?

Until the 1990s, the fascia-duplication and the fascia-adaptation were the "gold standard" in incisional hernia treatment. We call these methods simple hernioplasty (i.e. without additional application of prosthetic materials). Only for big or monstrous hernias was the method of additional strengthening of the frontal abdominal wall by implantation of auto- and alloplastic material recommended.

During the last 10–15 years, numerous retrospective studies about "simple hernioplasty" were published [5, 19, 20, 22, 31, 38, 43, 45, 56]. Table 1 shows the results of these studies, with recurrence rates ranging between 25% and 55%. Because of these unacceptably high recurrence rates after simple reconstruction and the development of new tissue-compatible, prosthetic materials, many surgeons share the opinion that an additional strengthening of the frontal abdominal wall by implantation of allo- and autoplastic material should be obligatory. In contrast to the methods with additional strengthening of the frontal abdominal wall, the simple reconstructions are less time consuming and seem to have fewer complications.

One of the discussed questions was: "Is the "simple" reconstruction of incisional hernia (fascia-duplication/adaptation) "dead"?" At present, there is no controlled study that compares the Mayo-duplication or the fascia-adaptation with the technique of additional strengthening of the frontal abdominal wall (during the preparation of this manuscript one randomised trial was published [36]). Because of the high recurrence rates, the simple fascia-duplication can no longer be regarded as the "golden standard". According to the experts' recommendation, the fascia-duplication should only be used for small incisional hernias and if the reconstruction of the repair is oriented horizontally. The plasty should carried out with monofile non-resorbable material – U-suture by Mayo-duplication or running suture with a suture:wound length ratio of 4:1. This operation has a simple technique and can be carried out by surgical residents.

Question 4: Pros and cons of prefascial prosthetic implantation (Chevrel-technique)

One of the established techniques of surgical treatment of the incisional hernia is the prefascial prosthetic implantation described by Chevrel (onlay technique). Table 2 presents the results of this procedure.

Table 1 Results of 'simple' reconstruction of incisional hernias (fascia duplication/adaptation)

Author, country	Year	*n*	Follow-up		Recurrence rate (%)
			Time (years)	Ratio (%)	
Langer, Sweden [31]	1985	72	7.0	74	31
George, U.K. [20]	1986	81	1.1	100	46
Van der Linden, Netherlands [56]	1988	47	3.3	100	55
Read, USA [45]	1989	169	5.0	89	25
Manninen, Finland [38]	1991	57	4.5	92	34
Hesselink, Netherlands [22]	1993	231	2.9	98	36
Geçim, Turkey [19]	1996	109	3.6	100	45
Luijendijk, Netherlands [35]	1997	68	Varying		54
Paul, Germany [43]	1997	111	5.7	84	53
Anthony, USA [5]	2000	48	3.8	100	54
Luijendijk, Netherlands [36]	2000	97	2.2	84	46

Table 2 Results of prefascial prosthetic repair (Chevrel technique; onlay)

Author, country	Year	*n*	Prosthesis	Follow-up time, years (rate, %)	Results (%)			
					Mortality	Wound healing disorders	Recurrence	Mesh removal
Molloy, USA [39]	1991	50	Marlex	4 (100)	0	26	8.0	0
Kennedy, USA [25]	1994	40	Gore-Tex	4 (84)	2.5	5	2.5	2.5
Liakakos, Greece [34]	1994	49	Marlex	8 (98)	0	4	8.0	2
Küng, Switzerl. [30]	1995	47	Marlex	6 (83)	0	?	13.3	?
Chevrel, France [13]	1997	389	Mersilene/Pro-lene	1–20 (89)	0.1	10.9	5.5	0
Vestweber, Germany [57]	1997	36	Prolene	3 (86)	2.7	27.7	5.5	0
Leber, USA [32]	1998	118	Marlex	6.7 (88)	0	7	14.8	0

The following technique of onlay implantation was recommended:

1. Excision of the skin scar.
2. Preparation of the hernial sac with broad preparation of the fascia edges.
3. Opening of the hernial sac.
4. Inspection of the abdomen to identify gut adhesions and additional fascial gaps.
5. Detachment of adherent gut tissue.
6. Closure of the hernial gap by fascia adaptation with a non-resorbing suture in one of the following techniques (continuous suture, single knot suture, figure of eight suture).
7. Onlay implantation of a prepared and already cut prosthesis. The recommended distance from the suture line is 5 cm in all directions. The implant should be fixed to the aponeurosis without tension, with an non-resorbing suture material, or with Stapler. The recommended technique is a circular suture after fixing the four edges of the implant.
8. Use of one or two suction drains, careful subcutaneous suture, including the implant in the middle as a prophylaxis for the development of a sinus, skin closure.

The following questions were discussed:

1. Is the opening of the peritoneum obligatory?
2. Can this technique be used in all patients with regard to chronic development of a seroma, corsage-feeling and pain in the frontal abdominal wall, especially in projection of the mesh-edges?
3. Is there a possibility of hernia recurrence between the new defect in the adapted fascia and the implanted prosthesis – a so-called “subprosthetic hernia”?

According to the experts, the opening of the peritoneum is almost always obligatory, but with smaller incisional hernia (see classification above) an extraperitoneal closure of the fascial gap is possible.

The development of a chronic seroma is associated with the insufficient biocompatibility of the used material. The main disadvantage of the onlay technique is the direct contact of the prosthesis (partly or completely) with the environment during the wound revision, which can cause wound healing complications. The bacterial contamination of the prosthesis leads to persisting wound infections and the development of long-lasting wound healing complications which often require surgical treatment. Authors using this technique estimate the amount of wound healing complications after this operation to range between 4% and 26% and estimate the rate of prosthesis removals between 0% and 2.5% (Table 2).

The so-called corsage feeling and abdominal wall pain especially at the mesh edges are frequently observed after implantation of polypropylene meshes (Marlex, Prolene, Surgipro), because of a more rigid texture. The French surgeons, using a much softer polyester mesh (Mersilene), are rarely confronted with this problem. According to the experts, this procedure is not ideal for patients with a thin subcutaneous fat-layer because of strong postoperative pain in the frontal abdominal wall.

The hernioplasty in onlay technique is not recurrence free. The recurrence rates indicated in the literature vary between 2.5% and 13.3% (Table 2). Some recurrences after onlay implantation result from a peripheral mesh dislocation, or an insufficient size of the mesh. So-called “subprosthetic hernia” is possible in cases of the combination of the fascia ruptur and laxity of the anterior abdominal wall. In such cases, the hernia sac is located in the space between the fascia and mesh. The technique of this procedure is considered to be relatively simple so that it can carried out by surgical residents.

Question 5: Pros and cons of subfascial prosthetic repair (sublay technique)

An alternative to the onlay technique is the subfascial or preperitoneal implantation of prosthetic material (sublay technique). Studies about sublay technique are shown in

Table 3 Results of subfascial prosthetic repair (sublay)

Author, country	Year	*n*	Prosthesis	Follow-up time, years (rate, %)	Results (%)			
					Mortality	Wound healing disorders	Recurrence	Removal
Adloff, France [2]	1987	130	Mersilene	3 (80)	1.5	5	5	3
Rives, France [46]	1987	168	Mersilene	6 (82)	4.5	26	6	?
Stoppa, France [50]	1989	368	Mersilene	5 (65)	1.8	15	15	0
Amid, USA [4]	1996	75	Marlex	? (100)	0	1	1	0
Schumpelick, Germany [48]	1996	82	Marlex	5.3 (87)	0	49	7	?
Sugerman, USA [51]	1996	98	Marlex	1.7 (99)	1.0		4	1.0
Temudon, USA [53]	1996	50	Prolene	2 (100)	0	12	4	4
Leber, USA [32]	1998	82	Marlex Prolene or Mersilene	6.7 (88)	0	6	20	0
Feleshtinskii, Ukraina [18]	1999	57	Polyuretan or Marlex	1–5 (95)	1,7	4	2	0
Petersen, Germany [44]	2000	50	Gore-Tex or Prolene	1.5 (96)	0	6	10	4
Luijendijk, Netherlands [36]	2000	84	Marlex or Prolene	2.2 (81)	0	4	23	0

Table 3. The following features of sublay implantation of a median incisional hernia were recommended:

1. Excision of the skin scar.
2. Preparation and removal of the hernial sac.
3. Sufficient suprafascial and intra-abdominal mobilisation of the abdominal wall with adhesiolysis.
4. Inspection of the abdomen to identify gut adhesions, additional fascial gaps and detachment of adherent gut tissue.
5. Preparation of the posterior layer of the rectus sheet on both sides up to the lateral edge of the rectus abdominis muscle.
6. Closure of the peritoneum and the posterior fascial sheet with a non-resorbing or delayed resorbing continuous suture.
7. Sublay implantation of an already cut prosthesis, which surpasses the hernia gap at least 5 cm and reaches into the lateral edge of the rectus abdominis muscle on both sides. The implant should be sutured to the posterior layer of the rectus sheet without tension or folds with non-resorbing material. Recommended technique: first, fixation of the four corners of the implant; then, a circumferencial suture.
8. Closure of the frontal fascia sheet with a non-resorbing suture in one of the following techniques: continuous suture, single knot suture or figure of eight suture.
9. Use of one or two suction drains, careful subcutaneous suture, including the aponeurosis at the suture line as a prophylaxis for the development of a sinus. Skin closure.

With respect to steps 7 and 8 of the sublay technique, a special comment from Prof. Corcione was documented in the protocol. According to this comment “absorbable sutures should be passed through the muscular layers and tied in sub-cutaneous space, after a short skin incision” (step 7) and “the closure of the laparotomy over the mesh should be performed with absorbable sutures, protecting the mesh, which lies posteriorly to prevent recurrences, while a non-absorbable suture could determine infective problems involving the mesh” (step 8).

The following questions were discussed by the panel: (1) Could the technically extensive and bloody preparation of a median hernia lead to an increased number of wound healing complications? (2) Is the technical expense of the sublay technique really greater than with the onlay technique? (3) Which of the two processes should be preferred as a treatment for median incisional hernia?

The use of the sublay technique as a treatment for incisional hernia appears to be more complicated than the onlay technique and should be carried out only from staff surgeons. Regarding the literature, the recurrence rates and the percentage of wound healing complications between the two techniques are comparable (except Schumpelick’s data [48, 49]). To date, no controlled study has been published that has tested the sublay technique versus the onlay technique. Therefore, the answers to the above questions are rather hypothetical. Empirically, the sublay technique seems to be adequate with oblique hernia, because the aponeurosis of the obliqus externus muscle of this kind of hernia is easily removed from the muscular tissue, without much bleeding. In order to achieve sound data to answer this question, the planning of a randomised controlled trial comparing the sublay and onlay techniques was recommended by the experts.

Question 6: Choice of prosthesis?

The ideal prosthetic material should dispose of the following qualities [3]. It should: (1) not be physically al-

Table 4 Results of the autodermal hernioplasty

Author, country	Year	*n*	Material	Follow-up time, years (rate, %)	Results (%)		
					Mortality	Wound healing disorders	Recurrence
Kozuschek, Germany [28]	1983	105	Cutis flap	3 (89)	0.9	29	3.2
Makarenko, Russia [37]	1984	299	Corium flap/corium stripe	4 (84)	0.3	6	3.2
Kranich, Germany [29]	1990	66	Corium flap	4 (96)	1.5	21	7.6
Kochnev, Russia [26]	1991	93	Corium flap/corium stripe	3 (?)	1.0	3.5	0
Watier, France [58]	1992	30	Cutis stripe	2 (100)	0	?	3.3
Chareton, Belgium [10]	1994	25	Cutis stripe	5 (100)	0	8	12

tered by tissue fluids, (2) be chemically inert, (3) not produce foreign body reactions, (4) be non-carcinogenic and non-allergenic, (5) have the ability to resist mechanical strains, and (6) have the ability to be sterilised.

Currently, the classification of prosthetic materials, described by Amid 1997 [3], is used as follows:

Type I. Totally macroporous prostheses (pores larger than 75 µm)

Marlex	Monofilament polypropylene
Prolene	Double filament polypropylene
Atrium	Monofilament polypropylene

Type II. Totally microporous prostheses (pores less than 10 µm)

Gore-Tex	Expanded PTFE

Type III. Mix-prostheses (macroporous with multifilamentous or microporous components)

Teflon	PTFE mesh
Mersilene	Braided Dacron mesh
Surgipro	Braided polypropylene mesh
MicroMesh	Perforated PTFE patch

The prosthetic materials used differ in many parameters, such as texture, chemical structure, pore size, induced tissue reaction, price, etc. None of these biological materials could be described with the term “ideal prosthesis”. In numerous experimental studies, expanded polytetrafluoroethylene patches were tested against polypropylene meshes. The results do not appear to have much influence on the current clinical practice [7, 8]. The choice of prosthetic material is mainly based on prices and personal preferences of the surgeon.

Question 7: Autodermal hernioplasty

The autodermal hernioplasty can be regarded as a possible competing method to the alloplastic strengthening of the frontal abdominal wall [27]. Publications on this topic showed acceptable rates of recurrences and wound healing complications (Table 4). In contrast to the alloplastic strengthening, the autodermal hernioplasty represents the concept of a so-called “biological surgery”. This method also includes different techniques of skin preparation and implantation. The authors recommend the following techniques to acquire skin and prepare it:

1. Locally acquired skin flap, which includes the postoperative scar, the subcutaneous fat tissue, has to be removed.
2. The skin flap should be treated with boiling normal saline. The contact-time is 5 s. With this time limitation, the corium will stay undamaged.
3. The epidermis can easily be detached from the cutis flap.
4. The cutis flap should be put into 96% ethanol for 3 min; then it will be rinsed with normal saline. The corium flap is then ready for different kinds of hernioplasty.

In principle, two types of autodermal hernioplasty exist: cutis-stripes and cutis-flap plastic, at which the cutis flap can be implanted in different ways (onlay, sublay, inlay). Table 4 shows the results of different types of hernioplasty. From our experience, we recommend onlay implantation.

After the fascial gap is laid open and the fascial-adaptation with a non-resorbing thread is done, the cutis-flap is (after being prepared in the way described above) perforated several times with a cannula. The cutis-flap should then be sewed above the adapted fascia edges with four continuous Ethibond #0. Before closure, suction drains should be put into the subcutaneous area, a subcutaneous suture that includes the implant should be used and the skin should be closed. This operation should be carried out only by staff surgeons.

The following questions were discussed: Is it always possible to obtain a sufficiently large layer of skin locally (e.g. incisional hernia after laparostomy)? Does the obtained layer of skin have sufficient quality (hernia after laparostomy or thin skin after circulatory problems in

Table 5 Results of laparoscopic hernioplasty

Author, Country	Year	*n*	Prosthetic	Follow-up time, months (rate, %)	Results (%)			
					Mortality	Wounds healing disorders	Recurrenc	Removal
LeBlanc, USA [33]	1994	30	ePTFE	10 (100)	0	3.3	0	0
Bärlehner, Germany [6]	1996	53	Surgipro	8 (100)	0	5.7	7.5	0
Park, USA [42]	1996	30	ePTFE, Prolene	8 (100)	0	3.3	3.3	0
Holzman, USA [23]	1997	21	Marlex	20 (90)	0	4.7	9.5	0
Costanza, USA [16]	1998	31	ePTFE	18 (n.a.)	0	3.1	3.1	3.1
Toy, USA [55]	1998	144	ePTFE	7 (94)	0	3.7	4.4	0.7
Sanders, USA [47]	1999	11	Dualmesh	13	0	0	9	0
Chari, USA [11]	2000	14	ePTFE	n.a.	0	7.1	n.a.	7.1
Szymanski, USA [52]	2000	44	Prolene	7 (73)	0	0	5	0
Heniford, USA [21]	2000	407	ePTFE	23 (n.a.)	0	4.2	3.4	0.9
Chowbey, India [15]	2000	202	Polypropylene	2.9 years (89.2)	?	18	1.0	0

giant hernias)? With regard to the technique of skin preparation, is ablation of the epidermis necessary? Is autodermal hernioplasty an alternative to an artificial prosthetic repair?

As a result of the panel discussion, the following statements were made. In rare cases, such as with strong retractions of the rectus abdomini muscle, or the development of a coarse scar tissue without a typical hernia bulge after the laparostomy, it is impossible to acquire a sufficient amount of cutis with high plastic qualities. In all other cases, especially in monstrous hernia, there is always a sufficient amount of skin. Usually the trophic changes of the skin and thinner skin are found in the middle of the lump of monstrous hernia. The skin at the edges is sufficient and of high quality. According to the literature, the hernia size does not lead to technical restrictions or influence the reinforcement of the autodermal hernioplasty.

There was no final conclusion on the detachment of the epidermis. Some experts believed that this should be an obligatory procedure because of an increased risk of the development of retention cysts; others believed that if a skin implant is sewed on with enough tension, the risk of retention cysts does not increase. However, this hypothesis has not been proven yet, neither in an experimental nor clinical study. According to the literature, the recurrence rates of the autodermal hernioplastic and the prosthetic strengthening are comparable (Table 2, Table 3 and Table 4).

In detailed discussions, some panel members expressed their fear, that the autodermal implantation induces only low quality scar tissue, which may lead to higher recurrence rates. At present, this opinion can neither be supported nor disproved by “hard” data.

Question 8: Laparoscopic repair of incisional hernias

Laparoscopic repair of incisional hernia is a relatively new procedure, which is not used on a broad basis. This method is based on two technical principles: (1) a hernia gate will not be closed, and (2) a mesh will be placed intraperitoneally.

Initial trials with a maximal follow-up time up to 10 months showed acceptable results (Table 5). ePTFE, Surgipro, Prolene and Marlex were used as prosthetic materials in these studies. In these clinical trials, there have been no cases in which the direct contact of mesh and intestine led to unwanted outcomes. The issues of possibly remaining skin surplus after the repair of a large incisional hernia or an increased risk of recurrence were not considered to be a problem by the authors of these studies. Thus, this technique seems to be an interesting innovation in the surgical repair of incisional hernia. Theoretically, this method could be a possible alternative to conventional repair for small lateral hernias. However, more experience and a thorough scientific evaluation is needed.

Discussion

It is a basic requirement of clinical research to identify the issues in a field where research is needed. We have highlighted some important “white spots” in common knowledge on incisional hernia. Although many case series exist, no definite conclusions can be drawn from them, since they have been performed by different surgeons on different patients in different countries. Comparative studies are needed to evaluate the various aspects of abdominal wall surgery. To date, only a very few randomised trials exist [1, 9, 41, 49, 54], although the very recent publication of a large trial from the Netherlands will certainly stimulate further research [36].

One hindrance on the way to "evidence-based" hernia surgery is the ongoing progress in developing new alloplastic materials. A researcher, who today starts a clinical trial to assess the efficacy of a new mesh material, will probably never complete the trial because newer (and presumably better) materials become available during the trial period. Thus, surgical progress in this field is perhaps advancing too fast to be evaluated thoroughly in clinical settings.

Only by national and international co-operation will researchers be able to solve the current problems in incisional hernia surgery. The first step in this direction is the creation a universally agreed classification of incisional hernia. We hope that the classification scheme as proposed by this experts' panel can serve as a useful tool in establishing an international hernia register. The value of the classification scheme, however, remains to be tested clinically. Its usefulness mainly depends on its ability to discern different types of hernia that may need different techniques of hernia repair.

It can be hypothesised that an individualised surgical procedure is of great importance in incisional hernia, although this needs to be tested clinically. The choice of surgical technique probably needs to take into account not only hernia size but also many other local and systemic factors.

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