Guidelines on pediatric day surgery of the Italian Societies of Pediatric Surgery (SICP) and Pediatric Anesthesiology (SARNePI)

Ugo de Luca 1*, Giovanni Mangia 2, Simonetta Tesoro 3, Ascanio Martino 4, Maria Sammartino 5 and Alessandro Calisti 6

Abstract
The Italian Society of Pediatric Surgery (SICP) together with The Italian Society of Pediatric Anesthesia (SARNePI) through a systematic analysis of the scientific literature, followed by a consensus conference held in Perugia on 2015, have produced some evidence based guidelines on the feasibility of day surgery in relation to different pediatric surgical procedures. The main aspects of the pre-operative assessment, appropriacy of operations and discharge are reported.

Keywords: Day surgery, Outpatient, Day case surgery, Ambulatory surgery, Guidelines

Background
Pediatric Day Surgery has become increasingly prevalent in western countries during recent years. Pediatric procedures eligible for day surgery have also been more frequently produced mainly because of the improvement in minimally-invasive surgical techniques, the development of new general anesthetic drugs and the wider use of regional anesthesia. Nowdays, 60% to 80% of operations in a modern pediatric hospital are performed on a day surgery basis. The major advantages of this trend consist in the lessening of psychological stress for children and parents and the reduction in hospital costs, frequency of nosocomial infections and length of surgical waiting lists. In order to evaluate the surgical procedures suitable for day surgery with the same level of reliability as applies in the case of in-patient operations, the Italian Society of Pediatric Surgery (SICP) together with the Italian Society of Pediatric Anesthesia and Resuscitation (SARNePI) have produced EBM-guidelines concerning pediatric day surgery.

Methods
The literature was examined by means of specific "queries" in the database of NCBI, the National Guidelines Clearinghouse, the Cochrane Library, Medline Complete and Dynamed-Ebsco. The query “ambulatory surgical procedures”[Mesh] and (“2010/05/01”[PDAT]: “2015/05/31”[PDAT]) and (“infant”[MeSH Terms] or “child”[MeSH Terms] or “adolescent”[MeSH Terms]) provided 391 items, which included 86 clinical trials and 31 reviews.

The Evidence Levels of the proofs and Grade of Recommendation were expressed according to the criteria defined in the Methodological Handbook provided by the National Programme for Guidelines promoted by the Istituto Superiore Sanità (ISS) with the cooperation of the CEVeAS of Modena [1] as reported in Table 1.

There are three main stages in day surgery: the pre-operative assessment, the surgical procedure and the discharge.

Pre-operative assessment
Children have been considered as ideal for day-case management because they usually have little co-morbidity and on account of the fact that many common pediatric operations are well suited for day surgery.

The pre-operative assessment must concern principally:

Clinical factors
Structured questionnaires completed and signed by the parents and by the pediatrician concerned, covering both social and medical history, are obtained during the pre-operative assessment.
ASA I-II children are suitable for outpatient treatments. ASA III patients are generally excluded, but may possibly be included for low grade surgical procedures. Premature infants must be excluded if they are of less than 60 weeks post-conception age even if the risk of any post-anesthetic apnoea is related to the grade of prematurity.

Pre-operative investigations (lab tests, x-rays and ECG) are rarely performed according to recent guidelines but may be possibly be requested by the anesthesiologist or by the surgeon during their clinical and anamnestic evaluation. (Table 2).

**Socio-familial factors**
A responsible adult, preferably both parents, must be available to transport the child and to provide home assistance in the post-operative period. A telephone must also be available and the home hygiene condition must be satisfactory. Finally a primary care hospital must be accessible within 1 h travelling distance by car from the patient home. All these requirements can be summarized as parental/environmental adequacy.

**Surgical factors**
Over recent years the complexity of surgical procedures has increased, with a wider range of children being suitable for day surgery. This is mainly due to the development of minimal invasive surgery and new anesthetic drugs and techniques, the wider use of regional anesthesia and the improved postoperative pain management. Generally speaking, a surgical day-case procedure should last not more than 120 min, without a high risk of post-operative bleeding or uncontrollable post-operative pain.

**Suitable surgical procedures**

*Inguinal hernia and hydrocele*

Iguinal hernia and communicating hydrocele are both caused by a failure of obliteration of the processus vaginalis of the peritoneum. The majority of inguinal hernias in infants and children are indirect hernias with direct and femoral hernias only occasionally observed. All these hernias are appropriate for surgical treatment on a day surgery basis either with a traditional open approach (LE 4; GR A) or with a laparoscopic approach (LE 4; GR B) except for premature infants of less than 60 post-conception weeks of age due to risk of postoperative apnoea (LE 3; GR E) [2–22].

*Undescended testis*

A congenital failure of the testis to reach the base of the scrotum after the third month of life requires surgical treatment, preferably if performed between 6 and 18 months of age. In particular, it is advisable to operate within the first year of life in the case of a higher position of the testicle (intrabdominal or intrainguinal) and within 18 months the case of an in extrainguinal lower position (pre-pubic, external inguinal ring or ectopic) (LE: 3; FR: B). A retractile testis does not need medical or surgical treatment, but require regular follow-up until puberty (LE: 3; GR: A). Orchidopexy can be carried out on a day surgery basis [23–29] either by an open technique (LE: 3; GR: A) or laparoscopically, in the case of an intra-abdominal testis (LE: 3; GR: B).

*Varicocele*

Varicocele is an abnormal dilation of the testicular veins in the pampiniformis plexus, more often (in 90% of cases) of the left side, caused by venous reflux. Indications for surgical treatment consist in testicular hypotrophy (> 20% of the contralateral size) and/or symptomatic varicocele (pain). All operations for the treatment of varicocele are based on the ligation or occlusion of the internal spermatic veins [30–36]. Inguinal or subinguinal microsurgical ligation, anterograd sclero-embolization and suprainguinal ligation, using open or laparoscopic techniques, are all suitable for day surgery (LE: 5; GR: A/B).

Indeed, it is safe to say that all inguinal procedures are suitable for day surgery. The low level of evidence in the scientific literature in this field is due to the absence of randomized trials. However this is counterbalanced by the higher grade of recommendation deriving from the widespread and consolidated clinical experience throughout the world in the last 30 years, summarized in certain relevant consensus documents, such as those produced by BAPS and AAPHA) [3–6].

**Table 1** The CEVeAS Scale of the level of evidence of the proofs and the grades of recommendation

| LEVEL OF EVIDENCE (LE) | GRADE OF RECOMMENDATION (GR) |
|------------------------|------------------------------|
| I Evidence obtained from several RCTs and/or reviews of RCT | A Surgical or diagnostic procedures are strongly recommended because they are sustained by high level scientific evidence, even if not necessarily of type I or II |
| II Evidence obtained from one RT adequately designed | B It is doubtful that the procedure must be always recommended but it must be carefully considered |
| III Evidence obtained from non randomized cohort studies with case/ control or their methanalysis | C There exists an element of uncertainty both in favor and against the recommendation |
| IV Evidence obtained from case/control retrospective studies or their methanalysis | D The procedure is not recommended |
| V Evidence obtained from series of cases without control group | E The procedure is strongly ill-advised |
| VI Evidences obtained from experts advice, from consensus conferences, etc. | |

**LEVEL OF RECOMMENDATION (LE)**

I Evidence obtained from several RCTs and/or reviews of RCT

II Evidence obtained from one RT adequately designed

III Evidence obtained from non randomized cohort studies with case/ control or their methanalysis

IV Evidence obtained from case/control retrospective studies or their methanalysis

V Evidence obtained from series of cases without control group

VI Evidences obtained from experts advice, from consensus conferences, etc.

**GRADE OF RECOMMENDATION (GR)**

A Surgical or diagnostic procedures are strongly recommended because they are sustained by high level scientific evidence, even if not necessarily of type I or II

B It is doubtful that the procedure must be always recommended but it must be carefully considered

C There exists an element of uncertainty both in favor and against the recommendation

D The procedure is not recommended

E The procedure is strongly ill-advised
To date, there has been some concern about discharging patients operated laparoscopically on the day of the surgery even in the presence of a good level of evidence, reported in large adult and pediatric series, suggesting the comparative safety of this choice [9, 18, 19, 25, 27, 30, 34]. It would be desirable in the future to plan large multicenter randomized trials to better support the level of evidence of this common practice.

Umbilical and alba hernias
Common umbilical hernias after 3 years of life, as well as alba (epigastric) hernias are reported to be well managed as day surgery procedures (LE: 4; GR: A).

Rarer huge umbilical hernias (permagna hernias) of the infant must be considered as inpatient procedures because of possible respiratory problems following the reintegration into the abdomen of a large quantity of the bowel. (LE: 4; FR: D) [37–41].

Phimosis
An absence of the retraction of the foreskin after the first year of life is called phimosis. Only scarring phimosis should be considered as true phimosis (post-

---

**Table 2 Pre-Operative phase**

| Question                                      | Advise                                                                 | Evidence | Grading Recommendation | Literature |
|-----------------------------------------------|------------------------------------------------------------------------|----------|-------------------------|------------|
| Family or Social Status excluding Day Surgery | Parents reluctant or unable to take care of the child in the post-operative period at home. Poor domestic hygienic conditions. Lack of a telephone. House more than 1 h travelling distance from an hospital provided with a 24 h emergency facility. Absence of public transport | V        | A                       | [122–127]  |
| Newborns                                      | Full term newborns (Gestational Age Weeks > 38) of less than 1 month are excluded from Day Surgery. Exclusion should be preferably extended to at least 6 months of age. Infants from 2 to 6 months age could be included according to Structure Policy and Surgical Grading. | V        | A                       | [18, 128–131] |
| ASA III Patients                              | Normally excluded from Day Surgery. May possibly be eventually included in relation to low surgical grading procedures. There needs to be, at any rate, a prolonged observation post-operatively before discharge. | III      | C                       | [132, 133] |
| Patient with current Upper Respiratory Infection (URI) | Procedure must be postponed in relation to patients with major respiratory symptoms. If there are mild or moderate symptoms the procedure should be postponed if the child is of less than 1 year of age. In the case of older patients the risk factors should be considered and the appropriacy of the operation assessed in each case. | II       | A                       | [134–136]  |
| Pre-Term                                      | Infants PCA > 60 weeks. Clinically Stable. Anemia corrected.             | II       | A                       | [2, 137–140] |
| Evaluation of Timing                          | No pre-anesthesia assessment much in advance. An assessment is advisable shortly before the procedure. | V        | B                       | [141–145]  |
| Lab Tests                                     | Routine Lab Tests in healthy patients older than > 1 yr. have a low predictive value | I        | A                       | [146–151]  |
| Medical Records                               | A parental anamnestic questionnaire is a good tool before any surgical procedure. | IV       | C                       | [152]      |
| Pre-operative Fasting                         | The administration of clear fluids up to two hours before induction is advised. This lower the residual gastric volume and raise pH. | I        | A                       | [153–156]  |
| Prevention of Nausea and Post-Operatory Vomiting (PONV) | PONV prevention requests a multifactorial approach that includes pre-operative identification of risk factors (family history, age > 3 yrs., Strabismus Repair and ORL surgery). In patients at risk prophylaxis is recommended (i.e. ondansetron 0.05 mg/kg + dexametason 0.015 mg/kg). | I        | A                       | [157, 158] |

---

**SUITABLE FOR DAY SURGERY**

**INGUINAL HERNIAS**: LE: 4; FR: A

**HYDROCELE**: LE: 4; FR: A

**UNDESCENDED TESTIS**: LE: 3; FR: A

**VARICOCELE**: LE: 3; FR: A

**TO BE EVALUATED IF SUITABLE FOR DAY SURGERY**

**LAPAROSCOPIC INGUINAL HERNIA**: LE: 4; FR: B

**LAPAROSCOPY FOR INTRA-ABDOMINAL TESTIS**: LE: 3; FR: B

**LAPAROSCOPIC VARICOCELE**: LE: 3; FR: B

**NOT SUITABLE FOR DAY SURGERY**

**INGUINAL HERNIA IN PRETERM INFANTS < 60 PCW**: LE: 3; FR: E

---

**SUITABLE FOR DAY SURGERY**

**UMBILICAL HERNIA** (LE: 4; GR: A)

**ALBA LINE HERNIA (EPIGASTRIC)** (LE: 4; GR: A)

**NOT SUITABLE FOR DAY SURGERY**

**PERMAGNA UMBILICAL HERNIA IN INFANTS** (LE: 4; GR: D)
traumatic, due to chronic inflammation or to BXO). Partial or total circumcision is the operation of choice, limiting plastic procedures, like Duhamel’s, only to cases of light preputial stenosis occurring in older children during erection. Both surgical procedures (circumcision and preputial plasty) can be performed as day surgery. (LE: 5; GR: A) [4–6, 17, 41, 42].

Buried penis
A buried penis is a normal length shaft enclosed (buried) in prepubic fat. This can be the consequence of obesity, circumcision in an overweight child or the less frequently observed congenital abnormal fixation of the fascia and skin to the balanic sulcus instead of to the base of the penis. Surgical correction is indicated only for the congenital or the post-circumcision forms. (LE:5;GR:B) [18, 32, 43–45].

Webbed penis
An abnormal peno-scrotal junction, resulting in a ventral web, is not only an esthetic problem but it can involve a functional complication during erection. The common V-Y or multiple Z plasty are easily realized as day surgery procedures. (LE: 5; GR: A) [4, 5].

Distal Hypospadia
Glandular or distal shaft hypospadias are the most frequent (75%) form of this common uro-genital malformation. Surgical corrections (MAGPI,TIPU,Mathieu) around the 15th month of life are all quite realizable with discharge on the same day either with or without a urethral catheter or stent. Parental adequacy and pain management may suggest the assistance regimen (as an in or outpatient). (LE: 3; GR: B) [46–52].

SUPERFICIAL PATHOLOGIES

SUITABLE FOR DAY SURGERY

PHIMOSIS AND WEBBED PENIS (LE: 5; GR: A)

TO BE EVALUATED IF SUITABLE FOR DAY SURGERY

BURIED PENIS (LE: 5; GR: B)

DISTAL HYPOSPADIA (LE: 3; GR: B)

SUPERFICIAL PATHOLOGIES

Cysts, nevi and tumors, which reach the fascia or the skull periostem may be managed on a day surgery basis, as well as embryonal remnants such preauricular sinus or cartilaginous tags. (LE: 5; GR: A) [6, 15, 17, 18, 53].

Angiomas and lymphangiomas
Small hemangiomas or lymphangiomas, if susceptible to surgical resection or laser photocoagulation as well as other superficial lumps, may be managed as outpatient procedures. This is also true in the case of larger masses where sclerotherapy is the treatment of choice (LE: 5; GR: A) [54–59].

Lymphadenopathy
Superficial lymphadenectomy and sentinel node biopsy can be performed as outpatient procedures (LE: 5; GR: A) [6, 15, 17, 18, 53].

Pilonidal disease
The open surgical treatment of pilonidal disease is not recommended for day surgery (LE: 5; GR: D) but the primary closure after wide fistula excision or punch biopsy fistulectomy can be managed as day surgery procedures (LE: 5; GR: B) [60–64].

Superficial pathologies
Cysts, nevi and tumors, which reach the fascia or the skull periostem may be managed on a day surgery basis, as well as embryonal remnants such preauricular sinus or cartilaginous tags. (LE: 5; GR: A) [6, 15, 17, 18, 53].

Diastema
An excessive gap between superior teeth is called a diastema and is frequently observed when the superior labial frenum is hypertrophic and inserted on the free edge of the gums. In this case, and mainly for esthetic reasons, a z plasty correction can be realized when the permanent dentition has been completed. (LE:5;GR:A) [6, 15, 17, 18, 53].

Mucocele
Mouth floor, labial and sublingual mucoceles are all resectable as outpatient procedures. Larger ranulas are more frequently treated with marsupialisation to prevent relapse. (LE:5;GR:A) [6, 15, 17, 18, 53].

Cleft lip
Several studies with good scientific evidence report the feasibility of cleft lip and anterior palate surgical correction with a day surgery regimen. (LE:3;GR:B).
The decision depends mainly on the experience of the surgeons and their familiarity with these procedures [68–75].

**SUITABLE FOR DAY SURGERY**

TONGUE TIE
(LE: 4; GR:A)
DIASTEMA
(LE: 5; GR:A)
MUCOCELE
(LE: 5; GR: A)

**TO BE EVALUATED IF SUITABLE FOR DAY SURGERY**

CLEFT LIP AND PALATE
(LE: 3; GR: B)

**Branchial anomalies**

Sinuses, cysts and fistulas of the second and third branchial arch can be excised as outpatient procedures (LE: 5; GR:A) whereas the resection of the first and fourth branchial arch cysts must be evaluated for overnight stay in hospital. (LE: 5; GR: B). Partial thyroidectomy is often necessary to remove a cyst of the 4th branchial arch and therefore an overnight stay in hospital is recommended (LE: 5; GR: C) [6, 15, 17, 18, 53, 76–78].

**Thyroglossal cyst**

The Sistrunk procedure involves the excision of the cyst or fistula together with the body of the hyoid bone and the suprahypoid duct as far as the foramen caecum. An accurate hemostasis during the procedure is essential and, when this rule is correctly applied the patient can be safely discharged on the day of the operation. This decision should be made taking into account the surgeon's experience and the duration and difficulty of the operation. (LE: 4; GR:B) [79–81].

**SUITABLE FOR DAY SURGERY**

2ND AND 3RD BRANCHIAL ARCH SINUSES, CYSTS AND FISTULAS
(LE: 5; GR: A)

**TO BE EVALUATED IF SUITABLE FOR DAY SURGERY**

1ST AND 4TH BRANCHIAL ARCH CYSTS
(LE: 5; GR: B)
THYROGLOSSAL DUCT CYSTS
(LE: 4; GR: B)
PARTIAL THYROIDECTOMY
(LE: 5; GR: C)

**Appendicitis**

Despite a good level of evidence in both adult and pediatric scientific literature reporting, the feasibility of non complicated appendectomies or interval appendectomies in day surgery, there is still uncertainty among surgeons about discharge on the day of surgery in such cases (LE: 3; GR:B) [82–87].

**Gallbladder diseases**

Gallbladder diseases in children are quite rare particularly if compared to adults. Laparoscopic cholecystectomy is the gold standard of treatment. The widespread diffusion of this procedure has produced a great number of high quality scientific studies (RCT) reporting the feasibility and safety of this procedure in day surgery.

In the pediatric field laparoscopic cholecystectomy is less frequently performed with a consequent reduction in the surgeon's experience and confidence. For this reason the pediatric consensus conference held in Perugia, despite the high quality of evidence (LE: 1), preferred to assign a grade of recommendation B to this procedure in day surgery (LE: 1; GR: B) [88–98].

**Gastric Funduplication**

Currently, gastric fundoplication is mainly performed laparoscopically both in adults and children. The degree of post-operative pain has been reduced together with the duration of hospitalization. A number of good evidence based studies have been reported in adult and pediatric scientific literature suggesting the feasibility of this procedure as day-case surgery with early postoperative feeding and domiciliary pain control. However, as in the case of cholecystectomy, due to the limited use of this practice in pediatric surgery, discharge on the day of fundoplication is not yet recommended except in relation to centers with considerable experience. (LE: 4; GR: C) [99–101].

**Gastrostomy**

PEG (percutaneous endoscopic gastrostomy) is the gold standard to ensure enteral nutrition in neurologically impaired children. Sometimes, when PEG is inadvisable, a MAG (microlaparoscopic assisted gastrostomy) is preferred. Both procedures have been reported as suitable for day surgery, but the consensus conference proposed a more prudential approach if the surgeon is not well experienced with these procedures (LE: 3; GR: C) [102–108].

**SUITABLE FOR DAY SURGERY**

APPENDECTOMY
(L: 3; G.R.: B)
CHOLECYSTECTOMY
(L: 1; G.R.: B)

**TO BE EVALUATED IF SUITABLE FOR DAY SURGERY**

GASTRIC FUNDOPLICATION
(L: 4; G.R.: C)
GASTROSTOMY
(L: 3; G.R.: C)
Pyeloplasty
As for the previously mentioned more complex procedures, pyeloplasty has been reported to be suitable for a day surgery regimen either when performed with an open or laparoscopic approach. Additionally in this case the level of evidence is fairly good (LE: 4). However, the consensus conference suggestion is that careful consideration should be given and the day surgery approach should be adopted only by very experienced team. (LE: 4; GR: C) [109–114].

Vesico-ureteric reflux
The endoscopic subureteric injection of bulking materials is the most popular mini-invasive treatment for vesico-ureteric reflux. Many surgeons perform this procedure on an outpatient basis. (LE: 4; GR: B) [114].

Nephrectomy
For many years nephrectomies of non-functioning kidneys or kidneys containing masses have been reported both in adults and children. The nephrectomy is most often carried out by retroperitoneoscopy or laparoscopy. In this case, day surgery management is limited to very experienced centers. In other cases in-patient admission is recommended. (LE: 5; GR: C) [110, 115–117].

**SUITABLE FOR DAY SURGERY**
VESICO-URETERIC REFUX
(L: 4; G.R.: B)
**TO BE EVALUATED IF SUITABLE FOR DAY SURGERY**
PYELOPLASTY
(L: 4; G.R.: C)
NEPHRECTOMY
(L: 5; G.R.: C)

Anesthesia
The aim of anesthesia is to provide a rapid smooth induction, good operation conditions and prompt recovery. Post-operative pain coverage is also desirable. The laryngeal mask airway is generally used for both spontaneous and controlled ventilation. Tracheal intubation is necessary for laparoscopic procedures and neck procedures. Local anesthesia may be planned with good local anesthetic techniques and pre-operative counseling [118]. In the intra-operative phase we have compared two general anaesthesia techniques and examined the role of caudal anaesthesia in post-operative analgesia (Table. 3).

Discharge
Recovery from an operation depends on several factors: the duration of the operation, site of the surgery, anesthetic technique employed and age of the patient.

### Table 3 Intra-operative phase

| Question                        | Advise                                    | Evidence | Grading | Recomandation | Literature |
|---------------------------------|-------------------------------------------|----------|---------|---------------|------------|
| General Anesthesia (Inhalation Anaesthesia vs. TIVA) | No differences between the two techniques have been observed in causing PONV, emergence agitation and respiratory and hemodynamic complications, and in influencing the length of stay in the recovery unit. | I        | A       |               | [159]      |
| Caudal Anesthesia and post-operative analgesia | Of all the loco-regional techniques, caudal block has shown the best results in the short and long term, although maintaining a significant risk of motor block and urinary retention | I        | A       |               | [160–165]  |

Ped-PADSS is a score system adapted for pediatric patients (Table. 4) [119–121]. As soon as the patient has met the discharge criteria (a score of 9/10) he/she may be discharged with written directions for home assistance and telephone numbers on-call 24/24 h. A clinical report provided to pediatrician concerned is also recommended.

### Conclusions

These guidelines are based on a review of the literature in relation to different aspects of day surgery including enrollment or exclusion criteria, the surgical feasibility of the most common pediatric operations, customer satisfaction, the safety of day surgery, discharge criteria have all been reported and scored according to evidence based scientific proofs.

### Table 4 Discharge phase

| Question                        | Advise                                    | Evidence | Grading | Recomandation | Literature |
|---------------------------------|-------------------------------------------|----------|---------|---------------|------------|
| Discharge (Ward to Home)        | The Ped-PADSS score system was evaluated and found to be s simple, practical and suitable. It can also improve the patient flow thus reducing the duration of hospitalization. | V        | A       |               | [119–121]  |
For more than a century pediatric day surgery has been carried out as the best practice for several common pediatric surgical procedures. However, still today, there are no good proofs supporting the feasibility of the most common pediatric day case surgery procedures on account of the absence of well designed randomized trials. Nevertheless, the widespread worldwide experience in relation to these routine operations suggests that they should be assigned a high score in the grade of recommendations scale.

The goal of these guidelines is to provide pediatric surgeons with a broader range of pediatric operations feasible in a day surgery setting with the same degree of safety as that ensured in relation to in-patient operations. The well known advantages of day surgery consist in the reduction in hospital infections, the lessening of psychological stress, the higher level of customer satisfaction, the shortening of waiting lists and the reduction in hospital costs.

Acknowledgements
The authors are grateful to Jonathan Paul Cole for the english review and to the SICP and SARNePI workshops for the reference research studies.

SICP workshop: Accinni A, Appignani A, Bagnara V, Cecarelli P, Cobellis G, Cozzi D, Del Rossi C, Esposito C, Franchella A, Gamba P, Impellizzeri P, Leli Chiessa PL, Lima M, Marocci G, Marte A, Mestina M, Meucci D, Mognano GMonguzzi G, Nanni L, Noccioli B, Papparella A, Parigi GB, Ricciopietroini G, Romeo C, Spagnoli A, Zampieri N.

SARNePI workshop: Astuto M, Baroncini S, Bortone L, Calamandrei M, Furlan S, Garra R, Locatelli BG, Marchesini L, Mondardini MC, Montobbio G, Presutti P, Wolfier A, Scalisi R, Schiavi F, Pinciroli L, Sbaraglia F, Serafini GP.

Funding
Publication charges sustained by The Italian Society of Pediatric Surgery.

Availability of data and materials
Reported as references

Authors’ contributions
UDL, AM and AC reviewed the surgical literature; GM, ST and MTS reviewed the anesthesiological literature; UDL wrote the manuscript; GM drafted the anesthesiological tables. All authors read and approved the final manuscript.

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Author details
1Department of Anesthesia, San Camillo Forlanini Hospital, Roma, Italy.
2Department of Anesthesiology, San Camillo Forlanini Hospital, Roma, Italy.
3Department of Anesthesiology, Perugia University, Perugia, Italy. *Pediatric Surgery Ospedale S. Orsola, Ancona, Italy. 4Department of Anesthesiology, Policlinico A. Gemelli, Roma, Italy. 5Pediatric Surgery, San Camillo Forlanini Hospital, Roma, Italy.

References
1. Istituto Superiore di sanità (ISS), Agenzia per i servizi sanitari regionali (ASSR), Centro per la valutazione dell’efficacia dell’assistenza sanitaria (CevEAS). Come produrre, diffondere e aggiornare raccomandazioni per la pratica clinica. Manuale metodologico. Milano: Arti Grafiche Passoni; 2002. Disponibile all’indirizzo: http://www.iss.it/sti/bin/fgm202/Manuale_PNLG.1234439852.pdf (1).
2. Côté CJ, Zaslavsky A, Downes JJ, Kurth CD, Welborn LG, Warner LO, et al. Postoperative apnea in former preterm infants after inguinal herniorrhaphy. A combined analysis. Anesthesiology. 1995;82(4):809–22. http://anesthesiology.pubs.asahq.org/article.aspx?articleid=1950011.
3. Wiener ES, Touloukian RJ, Rodgers BM, Grosfeld JL, Smith EI, Ziegler MM, et al. Hernia survey of the section on surgery of the American Academy of Pediatrics. J Pediatr Surg. 1996;31(8):1166–9.
4. Paediatric Surgery: Standards of care. Published by the British Association of Paediatric Surgeons, may 2002; editor D.A. Lloyd. Children’s Surgery. 5 A First Class Service Report of the Paediatric Forum of The Royal College of Surgeons of England, May 2000 - Review date 2005.
6. Gabbay J, Francis L. How much day surgery? Delphi predictions Oxford Regional Health. BMJ. 1988;297:12–8.
7. Saia M, Mantoan D, Buja A, Bertoccelli C, Baldwin T, Zanardo T, et al. Increased rate of day surgery use for inguinal and femoral hernia repair in a decade of hospital admissions in the Veneto Region (north- east Italy): a record linkage study. BMC Health Serv Res. 2013;13:349.
8. de Lange EH, Keeffe M, van Ramhorst GH, Aufenacker TJ, Lauwereys JA, Simons MP. Inguinal hernia surgery in the Netherlands: are patients treated according to the guidelines? Hernia. 2010;14:143–8.
9. Yeung YP, Cheng MS, Ho KL. Day-case inguinal herniomyotomy in Chinese children: retrospective study. Hong Kong Med J. 2002;8(4):245–8.
10. Duff M, Molfdi R, Nixon SJ. Routine laparoscopic repair of primary unilateral inguinal hernias - a viable alternative in the day surgery unit? Surgeon. 2007;5:209–12.
11. Ozdemir T, Ankan A. Postoperative apnea after inguinal hernia repair in formerly premature infants: impacts of gestational age, postconceptional age and comorbidities. Pediatr Surg Int. 2013;29(8):801–4.
12. Welborn LG, Greenspun Anesthesia and apnea. Perioperative considerations in the former preterm infant. Pediatr Clin N Am. 1994;41(1):181–98.
13. IPEC. Guidelines for inguinal hernia and hydrocele. J Laparo Adv Surg Tech A. 2010-01-01.
14. Letts M, Davidson D, Splinter W, Conway P. Analysis of the efficacy of pediatric day surgery. Can J Surg. 2001;44(3):193–8.
15. Maghni A. Postoperative apnea after inguinal hernia repair in formerly premature infants: impacts of gestational age, postconceptional age and comorbidities. Pediatr Surg Int. 2013;29(8):801–4.
16. Welborn LG, Greenspun Anesthesia and apnea. Perioperative considerations in the former preterm infant. Pediatr Clin N Am. 1994;41(1):181–98.
17. Ueno S, Yokoyama S, Hirakawa H. Pediatric patients with inguinal hernia can be good candidates for day surgery. Nippon Geka Gakkai. 2010;107:29–32.
18. Mattila K, Hynynen M. Intensivums Consortium Study Group. Day surgery in Finland: a prospective cohort study of 14-day-surgery units. Acta Anaesthesiol Scand. 2009;53:455–63.
19. Abdur-Rahman LO, Kolawole IK, Adeniran JO, Nasir AA, Taiwo JO, Odi T. Pediatric day case surgery: experience from a tertiary health institution in Nigeria. Ann Afr Med. 2009;8(3):163–7.
20. Lees M, Davidson D, Splinter W, Conway P. Analysis of the efficacy of pediatric day surgery. Can J Surg. 2001;44(3):193–8.
21. Majholm B, Engbæk J, Bartholdy J, Oerding H, Ahlburg P, Utik AMG, et al. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. Acta Anaesthesiol Scand. 2012;56:323–31.
22. Segerdahl M, Warnén-Stornberg M, Rawal N, Brattwall M, Jakobsson J. Children in day surgery: clinical practice and routines. The results from a nation-wide survey. Acta Anaesthesiol Scand. 2008;52(8):281–2.
23. PEG: Guidelines for inguinal hernia and hydrocele. J Laparo Adv Surg Techn. 2010;20(2):11–4.
24. Clarke S. Pediatric inguinal hernia and hydrocele: an evidence-based review in the era of minimal access surgery. J Laparoscopic Adv Surg Tech A, 2010;20(3):305–9.
25. Lao OB, Fitzgibbons RJ Jr, Cusick RA. Pediatric hernias, hydroceles, and undescended testicles. Surg Clin North Am. 2012;92(3):487–504.
26. Wang K. Assessment and Management of Inguinal Hernia in infants. Pediatrics. 2012;130(4):768–73.
27. Complong E, Armin P, Lemon S. Diagnosis and Management of Cryptorchidism. Eur Urol Suppl. 2012;11:2–9.
28. Ein SH, Nair A, Wales PW, Ein A. Testicular atrophy after attempted pediatric orchidopexy for true undescended testis. J Pediatr Surg. 2014;49:317–22.
29. Clark DA, Bozzi PA. Laparoscopic orchidopexy for the infra-abdominal testis. Pediatr Surg Int. 1999;15(7):54–6.
