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Review

Day case appendectomy in adults: A review☆

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HIGHLIGHTS

- We reported the feasibility of Day Case Appendectomy (DCA).
- The unplanned overnight admissions and unexpected consultations are low.
- Hospital readmissions and patient reoperation were lower than 5%.
- The morbidity of DCA is lower than 15%.
- The patient satisfaction is higher than 90%.

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ABSTRACT

Background: Day-case appendectomy (DCA) for acute appendicitis has been suggested as a valuable alternative to traditional appendectomy but many surgeons are reluctant to apply this technique in adults. The aim of the present review is to discuss the feasibility of DCA in adults.
Methods: Three reviewers independently searched the Pubmed and Embase databases for articles on DCA. They then considered the criteria applicable to the surgery, day-case surgery, time taken for patients to resume normal activities, mean time to resumption of work and patient satisfaction.
Results: Between 1993 and 2012, 13 studies (with retrospective ($n = 8$), prospective ($n = 4$) or case-control study ($n = 1$) designs) dealt with DCA. A total of 1152 adults underwent DCA. 312 patients (27.08%) were discharged within 12 h, 614 (53.29%) within 24 h and 242 (21.01%) within 72 h.
Conclusion: The few data reported in 13 studies, suggest that DCA may be feasible. However prospective studies are needed before DCA can be recommended.

1. Introduction

Appendicitis is one of the most frequent medical emergencies, with around 120,000 case per year in France and over 40,000 per year in the UK [1,2]. This incidence peaks in the 20–30 age class [3] and the lifetime rate is between 6% and 10% [4,5]. In France, the median length of stay is around 3 days in case of traditional surgery. Open appendectomy was first described by George Thomas Martin in 1887 and by Charles McBurney in 1889. Laparoscopic appendectomy was introduced by Kurt Semm in 1983 and now accounts for the majority of operations in this condition.

In France, ambulatory surgery (AS) is defined as an outpatient treatment mode in which the length of hospital stay (LOS) is shorter than 12 h without an overnight hospitalization. Ambulatory surgery was designated as a French national healthcare priority in 2010. Three French learned societies (the French Society of Digestive Surgery (SFCD), the Association of Hepatobiliary Surgery and Transplantation (ACHBT) and the French Association for Ambulatory Surgery (AFCA)) have jointly proposed evidence-based guidelines for AS [6]. These guidelines can be applied to elective surgical operations such as fundoplication in gastro-oesophageal reflux disease [7,8], laparoscopic adjustable gastric banding and proctology

Abbreviations used: DCA, day-case appendectomy; UOA, unplanned overnight admission; LOS, length of stay; DCS, day-case surgery; RCT, randomized controlled trial; AS, ambulatory surgery; AA, ambulatory appendectomy.

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surgery and cholecystectomy for biliary colic [9–12]. Even though appendectomy is associated with low morbidity and mortality, the learned societies nevertheless state that the feasibility of ambulatory surgery remains to be proven because of the lack of intention-to-treat studies and differences in the definition of AS.

To circumvent the constraints and difficulties of ambulatory surgery, day-case surgery (DCS) has been suggested as an alternative. In DCS, the LOS is rather than 24 h and again does not involve overnight hospitalization. This new treatment mode has been applied to a number of pathologies including appendectomy. In deed, day-case appendectomy (DCA) has been described as safe and effective in children [13–15]. However the available data on adults are not pertinent and reproducible enough to enable a consensus to be formed. The aim of the present review is to discuss the feasibility of DCA in adults.

2. Methods

2.1. Definitions

Is considered as an "ambulatory surgery" (AS) a procedure in which the hospital LOS is shorter than 12 h whereas a "day case surgery" (DCS) is characterized by a hospital LOS shorter than 24 h without an overnight hospitalization. Despite this difference, AS and DCS correspond to variations on the theme of "outpatients surgery".

The unplanned overnight admission rate represents the proportion of patients who are discharged more than 24 h after the surgical procedure (in case of DCS) or more than 12 h after the surgery (in case of AS) and are thus hospitalized for at least one night. The unexpected consultation rate reflects the number of AS or DCS patients attending the emergency department for a postoperative problem. The hospital readmission rate is defined as the number of patients who are discharged from hospital after AS or DCS but are subsequently readmitted. Lastly, the reoperation rate reflects the proportion of patients who are operated on after their post-AS/DCS discharge. The latter four items are defined as quality indicators for AS by the International Association for Ambulatory Surgery.

2.2. Search strategy and selection criteria

Three reviewers independently searched the Pubmed and Embase databases for prospective, retrospective or case-control articles on DCA for appendicitis in adults published between 1993 and 2012. The search terms were "ambulatory surgery", "day-case surgery", "outpatient surgery", "same-day surgery", "appendicitis" and "appendectomy". Even though the definitions of AS and DCS differ somewhat, both were selected because they correspond to outpatient settings. Only full, original articles written in English were selected. In each selected article, the references were checked for studies not identified or listed in PubMed and Embase.

2.3. Data extraction and analysis

The three reviewers extracted the following data from each selected study: first author, date, type of study, number of patients included and the inclusion and exclusion criteria. The data were separated into subgroups: data related to appendicitis and the surgical procedure (the severity of the appendicitis, surgical access, the rate of conversion to open surgery and the mean operating time), those related to DCS (unplanned overnight hospitalizations; unexpected consultations; readmission; reoperation and the mean LOS); those related to postoperative outcomes (causes of postoperative mortality and morbidity) and, lastly those related to the patients' activities (time taken for patients to resume normal activities and mean time to resumption of work). Patient satisfaction was also recorded. All extracted data were recorded in a table.

2.4. Assessment of the quality of selected publications

The methodological quality of the clinical trials was independently evaluated by the three reviewers according to criteria published by the Centre for Evidence-Based Medicine in Oxford [16] level 1a, systematic reviews and meta-analyses of randomized, controlled trials (RCTs); level 1b, individual RCTs; level 2a, systematic reviews and meta-analyses of cohort studies; level 2b, individual cohort studies, including low-quality RCTs; level 3a, systematic reviews of case-control studies; level 3b, individual case-control studies; level 4, case series (either prospective or retrospective); level 5, expert opinion.

Any disagreements between the three reviewers on data quality were resolved by consensus.

3. Results

3.1. Identified and selected publications

Two hundred and fifty-nine references were considered as eligible for review. Only 13 (5.02%) turned out to be relevant, English-language, full-text, original articles on appendicitis in adults. Eight of these studies were retrospective (level 3b) [17–24], four were prospective (level 2b) [25–28] and one was a case-control study (level 4) [29]. No randomized trials or meta-analyses were in Pubmed and Embase searches. Only one comparative study was found [20] which prevented us from performing a meta-analysis. The review's flowchart is shown in Fig. 1.

3.2. Number of patients enrolled

One thousand three hundred and eighty-one adults with either acute or perforated appendicitis were included in the 13 selected studies. A total of 1152 adult patients (83.42%) underwent DCS. Ambulatory surgery for acute appendicitis was reported in two European retrospective studies [21,29], two American retrospective studies [23,24] and one prospective study [28], in which a total of 312 patients were discharged during the first 12 h (27.08% of all the adults included in the total reviewed series). Day-case appendectomy was mainly found in North American series (with seven retrospective studies [17–20,22–24] and two prospective studies [28,25]). In all, 614 patients were discharged the same day and were thus classified as having undergone DCS (53.29% of all the adults included in the total reviewed series). The last three selected publications dealing with "early discharge surgery" [23,26,27] included 242 patients (21.01% of all cases of appendicitis) discharged within 46–57 h of surgery.

3.3. Inclusion criteria

The most frequent inclusion criteria for DCA were as follows: a clinical diagnosis of acute appendicitis; age under 65; an adult carer available to monitor the patient for the first 24 h post-discharge; place of residence within 1 h of a hospital; active telephone line available; ASA grade I or II and good patient compliance.

3.4. Exclusion criteria

The main exclusion criteria were as follows: complicated appendicitis; pregnancy or breastfeeding; unstable vital signs or fever; pain uncontrolled by oral analgesics; objective signs of

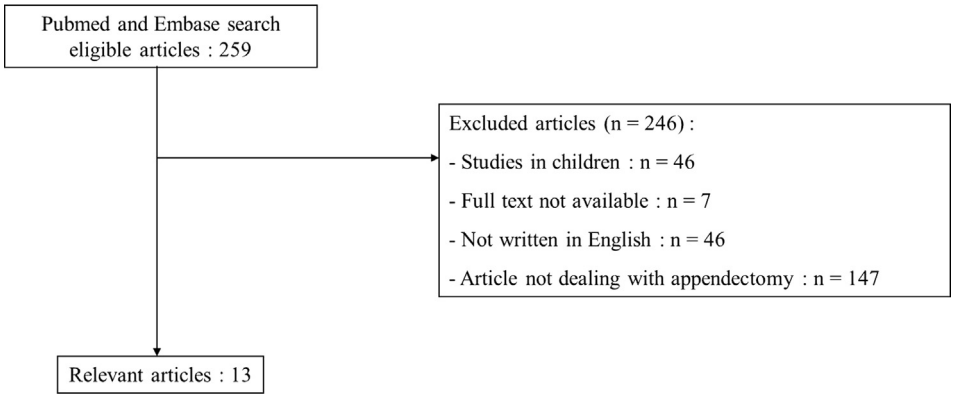

Fig. 1. Synopsis of the review.

diffuse peritonitis; appendectomy performed during another procedure; a history of abdominal surgery and status as a ward of court or a prisoner.

3.5. Surgical treatment

Data on surgical treatment are shown in Table 1. We divided the severity of appendicitis into two categories: not inflamed (29.8%) and inflamed (including purulent, necrotic or gangrenous appendicitis) (70.6%). Patients with complicated appendicitis were observed in five of the 13 selected articles. Seventy-seven percent of the DCA patients underwent laparoscopy. The mean rate of conversion to open surgery was 4.17%; this parameter was not reported in four articles [18,19,23,24]. The mean duration of appendectomy was 46.14 min (range: 10–140 min).

3.6. Postoperative management

Postoperative management was detailed in three articles [17,22,28] and consisted of antibiotic and analgesic administration. As part of DCA, patients were given fluids and solids as soon as possible and encouraged to move. On their discharge, patients received a prescription for analgesics.

3.7. The characteristics of DCA

The characteristics of DCA are reported in Table 2.

3.7.1. Unplanned overnight admissions

The unplanned overnight admission rate was 32.11% (on the basis of 9 out of 13 studies). The most frequent medical reasons for unplanned overnight admission were pain, nausea, vomiting and difficulty in (or intolerance of) drinking and eating. Unplanned overnight admissions were also due to social factors (inadequate living conditions) and technical factors (surgery performed too late in the day for discharge).

3.7.2. Unexpected consultations

The reported unexpected consultation rate ranged from 0% to 11.11% in four retrospective studies and two prospective studies [17,18,20,21,26–29] with a mean rate of 3.16%. The main explanations given by the authors were pain, wound infection, deep abscess, weakness, nausea and vomiting. In the majority of the selected articles, these consultations occurred within the first 30 postoperative days.

3.7.3. Hospital readmissions

The reported hospital readmission rates ranged from 0% to 5.1%, with a mean value of 2.01%. The most frequent causes were wound infection, fever and deep vein thrombosis. The hospital admission rate was nil or not mentioned in five of the 13 selected articles.

3.7.4. Patient reoperation

The reoperation rates ranged from 0% to 2.5% and averaged 0.63%. Reoperation was mainly related to wound abscesses and

Table 1
Surgical management of appendicitis.

Author, year of publication, [Ref]	Mean operative time (min)	Conversion (%)	LOS (h)	Patient's satisfaction (%)
Ambulatory appendectomy (LOS < 12 h)				
Jain, 1994, [21]	58 (30–105)	12	<12	NR
Dubois, 2010, [29]	NR	0	4.7 (3–16)	NR
Day-Case appendectomy (LOS < 24 h)				
Ramesh, 1993, [25]	NR	0	<24	NR
Schreiber, 1994, [19]	45 (30–120)	NR	<25	NR
Brosseuk, 1999, [20]	36 (15–65)	13.4	<24	NR
Alvarez, 2000, [17]	52 (27–98)	22	<24	100
Ciardo, 2007, [18]	NR	NR	<24	NR
Gilliam, 2008, [12]	35 (20–80)	0.9	22 (4–168)	NR
Sabbagh, 2011, [28]	54	0	14	93.7
Cash, 2012, [23]	NR	NR	<24	NR
Cash, 2012, [24]	NR	NR	<24	NR
Early discharge appendectomy				
Salam, 1995, [26]	NR	NR	57 (36–72)	83.3
Lord, 1996, [27]	43 (10–140)	0	46 (16–424)	88

NR : not reported; LOS : length of stay.

Table 2
Characteristics of DCA.

Author, year of publication, [Ref]	Unplanned overnight admission (%)	Unexpected consultation (%)	Readmission (%)	Reoperation (%)
Ambulatory appendectomy (LOS < 12 h)				
Jain, 1994, [21]	53.33	2.8	2.8	NR
Dubois, 2010, [29]	NR	11.11	3.3	NR
Day-Case appendectomy (LOS < 24 h)				
Ramesh, 1993, [25]	31.85	NR	1.3	NR
Schreiber, 1994, [19]	NR	NR	NR	NR
Brosseuk, 1999, [20]	17.95	5.13	5.1	2.5
Alvarez, 2000, [17]	52.6	0	0	0
Ciardo, 2007, [18]	19	0	0	NR
Gilliam, 2008, [22]	36.6	0	0	0
Sabbagh, 2011, [28]	27.2	3.1	3.1	0
Cash, 2012, [23]	17.1	NR	NR	NR
Cash, 2012, [24]	17.1	NR	NR	NR
Early discharge appendectomy				
Salam, 1995, [26]	NR	NR	2.5	NR
Lord, 1996, [27]	49	NR	NR	NR

NR : not reported; LOS : length of stay.

peritonitis. The three described abscesses were treated with intra-abdominal drainage. Nevertheless, the reoperation rate was not reported for 7 studies [18,19,21,25–27,29] and was nil in 4 studies [17,22,23,28].

3.8. Outcomes after DCA

3.8.1. Morbidity and mortality of DCA

The mortality rate was nil whereas the morbidity rate ranged from 0 to 13%, with an average value of 4.17% [16–22,28,29]. The main causes of morbidity were wound infections, peritonitis, minor bleeding and hematoma.

3.8.2. Follow up and patient satisfaction

The adults were followed up for the first month after surgery. A variety of tools were used to evaluate patient satisfaction. Indeed, patients were variously questioned before discharge [26]; during the follow-up period (on whether she/he was happy to have been discharged early) [17,27] or at a consultation 1 month after the surgical procedure [28]. Patients were questioned by a community nurse (as in Alvarez et al. [17] and Lord et al. [27]) or by the operating surgeon [28]. In the four articles reporting on patient satisfaction, the rate ranged from 83 to 100% and averaged 91.2%.

3.8.3. The patients' activities

Three publications reported the mean time to resumption of work [19,25,27] but only one presents the time taken for patients to resume normal activities [25]. The time taken for patients to resume normal activities was 3 days (range: 2–7) whereas the mean time to resumption of work was around 8 days (range: 7–14). These data were collected at the postoperative consultation one month after surgery.

4. Discussion

These studies present DCA as a feasible, safe alternative but their conclusions should be considered with some caution. Most of the studies were retrospective, with an evidence level of 3b or 4. These low evidence levels reflect non-optimal methodologies and could reduce the studies' power and statistical significance. The retrospective design may also explain the lack of comparability between the patient groups at the origin of the absence of results extrapolation. The application of novel statistical methods (such as the propensity score) might help resolve these differences.

In a few studies, patients were discharged early (i.e. after 2 or 3 days). These different definitions prevent the readers from drawing firm conclusions as to the advantages and disadvantages of DCA. However, some of the extracted data (such as the mortality and morbidity rates) are similar to those reported by Blanqvist et al. [30] and Helmer et al. [31] respectively.

The high unplanned overnight admission rate appeared to be mainly due to four types of factors. Medical factors (pain and nausea) could be reduced by the establishment of standardized protocols. Social factors could be addressed by better selection of eligible patients. Technical factors could be enhanced by reducing the time interval between the admission to the emergency departments and the surgical procedure. Human factors are also involved; we suggest that the patient's fear of home discharge too soon after appendectomy could be attenuated by interventions from specialist staff (especially nurses), who could provide reassurance by explaining the patient's management sequence.

The lack of consensus on the feasibility of DCA in adults raises a number of questions. Even though this procedure is not recommended in adults, some authors have made recommendations for pediatric populations. In a study of a cohort of 24 children with perforated appendicitis, Whyte et al. concluded that outpatient interval appendectomy could be performed safely in most children [9]. This opinion was echoed by Velhote et al. [32]. The data found in adults (feasibility in around 83% of cases and a readmission rate of 2%) are similar to those observed in pediatric studies (feasibility in 86% of cases and a readmission rate of 1.6%). Although these findings suggest that DCA is feasible in adults, the high proportion of missing data is an obstacle to drawing firm clinical conclusions.

Moreover the recent studies of Cash et al. [23,24] have shown that the morbidity associated with DCS compared with the "traditional" management is similar. These data accentuate the safety of DCS for appendectomy.

5. Conclusion

Our review of mainly retrospective studies suggests that DCA in adults is feasible and safe. Nevertheless, the low level of evidence, the high proportion of missing data and the absence of a consensus definition of DCS prevents us from advocating DCA in all patients. Methodologically robust, prospective studies are required before DCA can be recommended for treatment of the general patient population.

Disclosure

The authors (C Cosse; C Sabbagh; G Grelpois; O Brehant; JM Regimbeau) have no conflicts of interest to disclose.

Ethical approval

This article is a literature review which means that no ethical approval has been given.

Author contribution

Study design: C. Cosse; C. Sabbagh; G. Grelpois; O. Brehant; J.M. Regimbeau.

Data collections: C. Cosse; C. Sabbagh; O. Brehant; J.M. Regimbeau.

Data analysis: C. Cosse; C. Sabbagh; G. Grelpois; O. Brehant; J.M. Regimbeau.

Writing: C. Cosse; C. Sabbagh; G. Grelpois; O. Brehant; J.M. Regimbeau.

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Conflicts of interest

The authors have no conflict of interest.

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References

[1] P. Hub, « Search Results », Office for National Statistics, 07-août-2008. Available Online: http://www.statistics.gov.uk/hub/search/index.html?newquery=appendicitis [accessed 09.11.11.].

[2] C.J. DeFrances, K.A. Cullen, L.J. Kozak, National hospital discharge survey: 2005 annual summary with detailed diagnosis and procedure data, Vital Health Stat. 165 (2007) 1–209.

[3] D.G. Addiss, N. Shaffer, B.S. Fowler, R.V. Tauxe, The epidemiology of appendicitis and appendectomy in the United States, Am. J. Epidemiol. 132 (1990) 910–925.
[4] J.Y. Kang, J. Hoare, A. Majeed, et al., Decline in admission rates for acute appendicitis in England, Br. J. Surg. 90 (2003) 1586–1592.
[5] P. Froggatt, C. Harmston, Acute appendicitis, Surg. Oxf. 29 (2011) 372–376.
[6] K. Kraft, C. Mariette, A. Sauvanet, , et al.French Society of Gastrointestinal Surgery, Association for Hepatobiliary and Transplantation Surgery, Indications for ambulatory gastrointestinal and endocrine surgery in adults, J. Visc. Surg. 148 (2011) 69–74.
[7] C. Mariette, P. Pessaux, Ambulatory laparoscopic fundoplication for gastro-esophageal reflux disease: a systematic review, Surg. Endosc. 25 (2011) 2859–2864.
[8] H. Thomas, S. Agrawal, Systematic review of day-case laparoscopic fundoplication, J. Laparoendosc. Adv. Surg. Tech. A 21 (2011) 781–788.
[9] W. Ji, K. Ding, L.T. Li, et al., Outpatient versus inpatient laparoscopic cholecystectomy: a single center clinical analysis, Hepatobiliary Pancreat. Dis. Int. 9 (2010) 60–64.
[10] W. Ji, K. Ding, R. Yang, et al., Outpatient single-incision laparoscopic cholecystectomy in 22 patients with gallbladder disease, Hepatobiliary Pancreat. Dis. Int. 9 (2010) 629–633.
[11] J. Harju, H. Kokki, M. Pääkkönen, et al., Feasibility of minilaparotomy versus laparoscopic cholecystectomy for day surgery: a prospective randomised study, SJS 99 (2010) 132–136.
[12] M.I. Seleem, S.S. Gerges, K.S. Shreif, et al., Laparoscopic cholecystectomy as a day surgery procedure: is it safe?–an Egyptian experience, Saudi J. Gastroenterol. 17 (2011) 277–279.
[13] H. Grewal, J. Sweat, W.D. Vazquez, Laparoscopic appendectomy in children can be done as a fast-track or same-day surgery, JSLS 8 (2004) 151–154.
[14] M. Pfeil, A. Mathur, S. Singh, et al., Home next day: early discharge of children following appendicectomy, J. Child Health Care 11 (2007) 208–220.
[15] C. Whyte, E. Tran, M.E. Lopez, B.H. Harris, Outpatient interval appendectomy after perforated appendicitis, J. Pediatr. Surg. 43 (2008) 1970–1972.
[16] « CEBM > EBM Tools > Finding the Evidence > Levels of Evidence 2011 > Levels of Evidence 2001 ». Available Online: http://www.cebm.net/index.aspx?o=1025 [accessed 09.11.11.].
[17] C. Alvarez, A.J. Voitk, The road to ambulatory laparoscopic management of perforated appendicitis, Am. J. Surg. 179 (2000) 63–66.
[18] L.F. Ciardo, F. Agresta, N. Bedin, Day-case laparoscopic surgery for appendicitis and non-specific abdominal pain, Chir. Ital. 59 (2007) 299–304.
[19] J.H. Schreiber, Results of outpatient laparoscopic appendectomy in women, Endoscopy 26 (1994) 292–298.
[20] D.T. Brosseuk, O.F. Bathe, Day-care laparoscopic appendectomies, Can. J. Surg. 42 (1999) 138–142.
[21] A. Jain, P.D. Mercado, K.P. Grafton, R.A. Dorazio, Outpatient laparoscopic appendectomy, Surg. Endosc. 9 (1995) 424–425.
[22] A.D. Gilliam, R. Anand, L.F. Horgan, S.E. Attwood, Day case emergency laparoscopic appendectomy, Surg. Endosc. 22 (2008) 483–486.
[23] C.L. Cash, R.C. Frazee, S.W. Abernathy, et al., A prospective treatment protocol for outpatient laparoscopic appendectomy for acute appendicitis, J. Am. Coll. Surg. 215 (2012) 101–105.
[24] C.L. Cash, R.C. Frazee, R.W. Smith, et al., Outpatient laparoscopic appendectomy for acute appendicitis, Am. Surg. 78 (2012) 213–215.
[25] S. Ramesh, R.B. Galland, Early discharge from hospital after open appendicectomy, Br. J. Surg. 80 (1993) 1192–1193.
[26] I.M. Salam, M.A. Fallouji, Y.I. el Ashaal, et al., Early patient discharge following appendicectomy: safety and feasibility, J. R. Coll. Surg. Edinb 40 (1995) 300–302.
[27] R.V. Lord, D.R. Sloane, Early discharge after open appendicectomy, Aust. N. Z. J. Surg. 66 (1996) 361–365.
[28] C. Sabbagh, O. Brehant, H. Dupont, et al., The feasibility of short-stay laparoscopic appendectomy for acute appendicitis: a prospective cohort study, Surg. Endosc. 26 (2012) 2630–2638.
[29] L. Dubois, K.N. Vogt, W. Davies, C.M. Schlachta, Impact of an outpatient appendectomy protocol on clinical outcomes and cost: a case-control study, J. Am. Coll. Surg. 211 (2010) 731–737.
[30] P.G. Blomqvist, R.E. Andersson, F. Granath, et al., Mortality after appendectomy in Sweden, 1987-1996, Ann. Surg. 233 (2001) 455–460.
[31] K.S. Helmer, E.K. Robinson, K.P. Lally, et al., Standardized patient care guidelines reduce infectious morbidity in appendectomy patients, Am. J. Surg. 183 (2002) 608–613.
[32] C.E. Velhote, T.F. de Oliveira Velhote, M.C. Velhote, D.C. Moura, Early discharge after appendicectomy in children, Eur. J. Surg. 165 (1999) 465–467.