

## Prosthetic repair of umbilical hernias in adults with local anesthesia in a day-case setting: a comprehensive report from a specialized hernia center

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### Abstract

**Background** Umbilical hernia is a common surgical problem. However, there seems to be a certain discrepancy between its importance and the attention it has received in the literature to date. This prospective study aimed to report a detailed analysis of prosthetic umbilical hernia repairs with local anesthesia in a day-case setting.

**Methods** It was planned to enroll 100 consecutive patients who underwent an elective umbilical hernia repair with local anesthesia. Patients who required general anesthesia and simultaneous hernia repairs were excluded. The procedure including local anesthesia and intravenous sedation was explained to the patients in detail by the operating surgeons and the anesthesiologist. The following parameters were strictly recorded: gender, age, body mass index (BMI), concomitant diseases, history of hernia (primary/recurrent), size of fascial defect, duration of operation, level of intravenous sedation (light/moderate), discharge time, and complications.

**Results** There were 54 male and 46 female patients. The mean age was 48.6 years (24–78 years). Four patients were older than 70 years of age. Forty-one patients had 84 concomitant diseases. Eleven patients had a recurrent hernia. Female patients more frequently presented with a recurrent hernia than male patients (19.6 vs. 3.7%,  $P = 0.009$ ). A standard polypropylene mesh was used in the onlay position in 91 cases. In nine cases, a light mesh was placed in the preperitoneal space. A closed vacuum drain was left in situ in 37 cases. Light sedation was set in 86 cases, whereas 12 patients received a moderate sedation. Monitored anesthesia care was used in two cases. When

moderate sedation was needed, a concurrent increase in lidocaine dose and total volume was recorded. There was a positive correlation between increased lidocaine use and high midazolam dose and additional propofol requirement. The mean total local anesthetic volume was 33 ml (10–63 ml). Lidocaine doses displayed a large range between the cases (70–600 mg). The mean lidocaine dose was 263.3 mg (standard deviation [SD]: 103.4). No bupivacaine was given in 19 cases, whereas the mean bupivacaine dose was 35.1 mg (0–100 mg) in 81 cases. The mean duration in the operation room was 69 min (25–150 min). It was significantly longer for recurrent hernias than primary ones (95 vs. 65 min;  $P = 0.0001$ ). Higher total volume and higher lidocaine doses were required for the repair of recurrent hernias. In addition, it was observed that the longer the operation time, then the longer the lidocaine dose and the higher the total volume of local anesthetic agents. The patient satisfaction rate was 97%. The mean discharge time was  $122 \pm 58$  min (45–420 min). Sixty-seven patients were sent home within 2 h. Early wound problems were observed in 11 patients. Small seromas and hematomas developed in six cases, and dissolved without drainage. Three superficial surgical site infections diagnosed by erythema and enduration were recorded without obvious suppuration. No recurrence was recorded after a mean follow-up of 17 months (5–41 months). One patient complained of pain at the lower edge of a standard polypropylene mesh at the third postoperative month.

**Conclusions** The repair of umbilical hernias with local anesthesia in a day-case setting is a good option, with low infection and recurrence rates. Most patients can be discharged early as planned. Separate doses and total volume of local anesthetic agents needed for umbilical hernia repair are clearly higher than those used in inguinal hernia

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repair. Patients with higher BMI, recurrent hernia, and defects larger than 3 cm may require higher local analgesic doses. The patient satisfaction is very good when the patients are provided with detailed information about day-surgery and local anesthesia.

**Keywords** Umbilical hernia · Local anesthesia · Ambulatory surgery · Day-case

## Introduction

Umbilical hernia is a rather common surgical problem. A recent multicenter survey from the UK reported that the share of umbilical and paraumbilical hernia repairs among all repairs for abdominal wall hernias increased to 14% from 5% in the last 25 years [1]. However, there seems to be a certain discrepancy between its importance and the attention it has received in the literature to date.

In adults, many hernias in the umbilical region occur above or below the umbilicus through a weak place at the linea alba, rather than directly through the umbilicus itself, and the natural history and treatment do not differ for these hernias. The European Hernia Society (EHS) classification for primary abdominal wall hernias defines the midline hernias from 3 cm above till 3 cm below the umbilicus as “umbilical hernia: M3” [2].

Prosthetic repairs have gained great popularity for hernia repairs in the last several decades. A similar tendency has been observed in umbilical and paraumbilical hernia repairs. A recent meta-analysis has revealed that the use of mesh in umbilical hernia repair results in decreased recurrence and wound complication rates compared to tissue repairs [3].

Local anesthesia has been recognized as a good alternative for groin hernia repairs [4–6]. It can also be used safely in umbilical and paraumbilical hernia repairs. However, the number of detailed reports on the repair of these hernias by using local anesthesia is limited [7–10]. The data usually lack information about the technique and doses of local anesthesia application. Therefore, we aimed to report an analysis of prosthetic umbilical hernia repairs with local anesthesia in a day-case setting.

## Methods

It was planned to enroll 100 consecutive patients who underwent an elective umbilical (or paraumbilical) hernia repair with local anesthesia, by using a prospective record protocol. Patients who required general anesthesia and simultaneous hernia repairs were excluded. Following the initial physical examination, all patients were provided

with a leaflet from which they could find detailed information about pre-, intra-, and postoperative periods, including early ambulation and discharge. All patients read and signed a written informed consent before the operation, following the surgeon's answers to their questions about the treatment and procedure-related anxiety.

The procedure including local anesthesia and intravenous sedation was explained to the patients in detail by the operating surgeons and the anesthesiologist. The following parameters were strictly recorded: gender, age, body mass index (BMI), concomitant diseases, history of hernia (primary/recurrent), size of fascial defect, duration of operation, level of intravenous sedation (light/moderate), discharge time, and complications.

Patients were advised to use iodophor solution to clean the umbilicus twice on the day before the operation. The umbilicus was also cleaned by the surgeon meticulously before incision. The surgical procedure with local anesthesia was employed with a similar pattern to a previously described technique by Kurzer et al. [7]. First, a hemircumferential periumbilical skin marking was done with a permanent pen. Several milliliters of lidocaine as a short-acting, medium-lasting agent (Jetocaine simplex ampules 40 mg/2 ml, Adeka) was first given subdermally and then intradermally. Subcutaneous dissection was continued with the same local anesthetic agent. Then, bupivacaine 0.5% as a long-acting agent (Marcaine 0.5% Xacon 20 ml, Astra-Zeneca) was given under the rectus sheath around the umbilicus. The local anesthetic agents were diluted with 1/1 saline. Intravenous sedation was set with midazolam and fentanyl. Propofol was also used for sedation in some cases. The level of patient sedation was scored as alert, light (awake, responds readily to name, or lethargic response to name), and moderate (responds only after name is called loudly). It was ensured that sedation contributed only to patient comfort and surgical anesthesia/analgesia was provided by the local anaesthetics. Postoperative nausea and vomiting (PONV) and pain were also recorded for the evaluation of patient satisfaction. Pain was measured by means of a 10-point visual analog scale (VAS), performed by a staff member.

Antibiotic prophylaxis with cefazolin sodium was used in all cases 30 min before the skin incision. The hernia sac was freed by gentle sharp dissection. The hernia sac was not opened if possible. An onlay mesh was used to cover and overlap the defect by 2.5–3 cm. The mesh was placed into the preperitoneal space in some cases. Mesh fixation was achieved with interrupted polypropylene sutures. The wound was irrigated with saline before closure. Topical gentamicin was applied in 27 cases. Subcutaneous tissue was approximated with interrupted polyglactin sutures. A small suction drain was left in situ if the dissection is difficult or the patient was on anticoagulant agents, to

avoid seroma or hematoma. The skin was closed with rapidly absorbable polyglactin suture subdermally.

Early ambulation was encouraged. A discharge at the second postoperative hour was targeted in all cases. Patients were evaluated for home-readiness and discharge by the anesthesiologist. These times and readmissions were also recorded.

The relations between the recorded parameters were statistically determined by using SPSS for Windows version 11.0. Student's *t*-test and the Mann–Whitney *U*-test were used for the univariate analysis. One-way analysis of variance (ANOVA) (post Hoc multiple comparison with Tukey's test) was employed when the means of three groups were compared. Spearman's correlation test was also used. Multivariate analysis (logistic regression test) was done to determine the independent factor for the doses of local anesthetic agents, discharge time, and wound infection.

## Results

During the registration period, four patients preferred general anesthesia in advance and they were excluded from the study. Sixteen patients who underwent simultaneous hernia repairs were also not included in the study (umbilical and inguinal hernias: 10 patients, incisional and umbilical hernias: 3 patients, umbilical and epigastric hernias: 3 patients). One hundred patients who underwent elective umbilical hernia repair with local anesthesia between October 2006 and October 2009 were included in the study. No conversion toward general anesthesia because of patient intolerance or procedure-related intraoperative complication was needed in any case.

There were 54 male and 46 female patients. The mean age was 48.6 years (24–78 years). Four patients were older than 70 years of age. Forty-one patients had 84 concomitant diseases (Table 1). Eleven patients were admitted for a recurrent hernia. Female patients more frequently presented with a recurrent hernia than male patients (19.6 vs. 3.7%,  $P = 0.009$ ). A standard polypropylene mesh was used in the onlay position in 91 cases. In nine cases, a light mesh was placed in the preperitoneal space (lightweight polypropylene mesh in five patients, partially absorbable lightweight large-pore mesh in four patients). A closed vacuum drain was left in situ in 37 cases.

Light sedation was set in 86 cases, whereas 12 patients received a moderate sedation. Monitored anesthesia care was used in two cases. When moderate sedation was needed, a concurrent increase in lidocaine dose and total volume was recorded. There was a positive correlation between increased lidocaine use and high midazolam dose

and additional propofol requirement. The mean dose for intravenous sedation was 0.06 (0.01–0.1) mg/kg for midazolam, 1.02 (0.3–1.6) microgram/kg for fentanyl, and 1.74 (0.5–3.8) mg/kg for propofol. The mean intravenous crystalloid infusion was 913 ml (range: 500–2,000, mode: 1,000 ml).

The mean total local anesthetic volume was 33 ml (10–63 ml). Lidocaine doses displayed a large range between the cases (70–600 mg). The mean lidocaine dose was 263.3 mg (standard deviation [SD]: 103.4). No bupivacaine was given in 19 cases, whereas the mean bupivacaine dose was 35.1 mg (0–100 mg) in 81 cases (Table 2). The mean duration in the operation room was 69 min (25–150 min). It was significantly longer for recurrent hernias than primary ones (95 vs. 65 min;  $P = 0.0001$ ). Higher total volume and higher lidocaine doses were required for the repair of recurrent hernias. In addition, it was observed that the longer the operation time, then the larger the lidocaine dose and the larger the total volume of local anesthetic agent.

Although the mean lidocaine dose seemed to decrease with age, this factor did not have a significant effect on the dose and volume of local anesthetic agents. Gender was also not a significant factor for the use of local anesthetic agents. The mean size of the fascial defect was 3.1 cm (1–10 cm). The mean total local anesthetic volume and lidocaine dose were higher for patients who had a defect  $\geq 3$  cm than for patients with a  $\leq 2$ -cm defect, whereas the mean bupivacaine doses were similar. The mean BMI was 29.7 (19–44). Five patients had a BMI higher than 40. When a limit of 25 was accepted for comparing the cases regarding the BMI, only bupivacaine doses showed a significant difference. However, the significance persisted only for the mean lidocaine dose when the cutoff point was changed to 30 (Table 1).

The patient satisfaction rate was 97%. None of the patients experienced PONV. No patient had severe postoperative pain. Only three patients had a VAS higher than 4 postoperatively and were treated successfully with supplemental 50 mg peroral tramadol. There was one planned overnight stay because of social reasons. The mean discharge time was  $122 \pm 58$  min (45–420 min). Sixty-seven patients were sent home within 2 h. Only five patients needed to stay in the center for longer than 3 h. The main reasons for a stay longer than planned were postural hypotension and dizziness. These patients were provided with additional bed rest and 500 ml of intravenous Ringier's lactate solution if the problem persisted. Thirteen of 33 patients who could not be discharged at the second postoperative hour had a history of hypertension as the comorbidity. Patients who had hypertension and were on antihypertensive treatment had a longer stay than the others (143 vs. 110 min,  $P = 0.042$ ), whereas other comorbidities

**Table 1** Comorbid diseases in patients who underwent elective umbilical hernia repair (some patients had more than one comorbidity)

Cardiovascular diseases	Hypertension	39
	Ischemic arterial diseases	7
	Arrhythmia	3
Respiratory diseases	Chronic obstructive pulmonary disease	9
	Allergic asthma	2
Endocrine diseases	Diabetes mellitus	11
	Thyroid diseases	3
Gastrointestinal diseases	Colitis	1
	Peptic ulcer	2
	Reflux disease	1
Other	Nephrolithiasis	1
	Obstructive sleep apnea syndrome	1
	Familial mediterranean fever	1
	Amyloidosis	1
	Leukemia	1
	Trigeminal neuralgia	1

did not affect the discharge time significantly. The bivariate correlation test revealed a positive relation between duration in the operation room and discharge time (Spearman's correlation coefficient: 0.347,  $P = 0.007$ ). However, the multivariate analysis displayed no independent factor for late discharge. There were no readmissions.

Early wound problems were observed in 11 patients (Table 3). Small seromas and hematomas developed in six cases, and dissolved without drainage. Allergic skin changes to adhesive tapes were observed in two cases. Three superficial surgical site infections diagnosed by erythema and enduration were recorded in cases #10, #18, and #72 without obvious suppuration. All responded well to wound care and oral antibiotics. All patients who developed wound infection were older than 60 years of age, but age was not found to be an independent factor ( $P = 0.44$ ). Wound infection was more frequently observed in cases with a drain; however, this difference did not reach the level of significance (5.4 vs. 1.59%,  $P = 0.47$ ). No wound infection developed in cases where topical gentamicin was applied. Nevertheless, no significant effect appeared when cases with and without topical application were compared (none vs. 4.1%,  $P = 0.25$ ). There was no independent factor for infection in the multivariate analysis.

No recurrence was recorded after a mean follow-up of 17 months (5–41 months). One patient complained of pain at the lower edge of a standard polypropylene mesh at the third postoperative month. This patient responded well to a 3-week oral anti-inflammatory drug regimen and remained pain-free at 1 year.

## Discussion

Local anesthesia provides maximum comfort for the patients in the repair of most hernias when it is performed properly. It has a short learning curve requiring specific training. Inexperience with the local anesthetic technique may cause discomfort to patients and an increased recurrence rate. Today, local anesthesia is routinely used for groin hernias in specialized hernia clinics, while its use is still not a common practice in district general hospitals and teaching hospitals, in spite of its advantages.

Reports of systematic evaluation on local anesthesia for umbilical hernia repairs are scarce in the literature. There are only two comprehensive reports in the English literature focused on this subject [7, 8]. Some other centers that are also known to use local anesthesia have published their experiences without mentioning the details of the local anesthesia. Muschaweck [10] reported that they use local anesthesia in all umbilical hernia repairs. Arroyo et al. [11] used local anesthesia in 98% of the repairs in their randomized trial comparing suture and mesh repair for umbilical hernia. On the other hand, a review article published in 1999 mentioned that "General anesthesia is the preferred technique. The adequate selection of patients enables surgical repair under ambulatory conditions for some patients with local anesthesia and sedation. However, this is not indicated for very obese patients, hernias of very large size, on recurrent hernias, as the hernia content is difficult to reduce despite adequate local anesthesia" [12]. There are also some indefinite statements, such as, "Local anesthesia was used whenever possible" [13]. A center that has frequently published their experiences in hernia repairs reported only one umbilical hernia repair with local anesthesia (1%) over an 8-year period [9]. Nevertheless, many surgeons around the world possibly use local anesthesia at least in selected cases of umbilical hernia repair without announcing their results.

Our facility is equal to the American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) Level C Center: "patients can receive general anesthesia, if needed or requested, by means of endotracheal tube, laryngeal mask, or inhalation anesthesia" [14]. Local anesthesia is routinely used if there is no contraindication or any other request by the patient. We previously reported the results of 300 consecutive unilateral inguinal hernia repairs with local anesthesia [6]. Only one patient requested general anesthesia preoperatively in that series, with no need for conversion to general anesthesia. Tolerance to the local anesthesia technique was very good. In the present series, patient acceptance was also very good. Four patients requested general anesthesia. It seems that local anesthesia has been gaining popularity among patients in our region.

One decade ago, there was no decisive evidence for mesh use in umbilical hernia repair [12, 15]. However,

**Table 2** Univariate analysis for the mean doses of lidocaine and bupivacaine in milligrams and the mean sum undiluted volume of the two agents in milliliters

	Lidocaine dose (mg)	Bupivacaine dose (mg)	Total volume (ml)
Overall	263.3	35.1	33.1
Gender			
Male	252.5	39.7	32.8
Female	280.0	28.1	33.4
<i>P</i> -value	n.s.	n.s.	n.s.
Age (years)			
<60	265.1	34.1	33.2
≥60	240.0	37.0	31.2
<i>P</i> -value	n.s.	n.s.	n.s.
Age (groups)			
<40	283.9	28.5	33.1
40–59	256.6	36.8	33.2
≥60	235.6	41.7	30.8
<i>P</i> -value	n.s.	n.s.	n.s.
BMI			
≤25	192.0	20.5	24.0
>25	276.6	38.4	34.3
<i>P</i> -value	<b>0.02</b>	<b>0.05</b>	<b>0.005</b>
BMI			
≤30	231.8	30.6	29.6
>30	276.8	38.9	34.7
<i>P</i> -value	<b>0.05</b>	n.s.	n.s.
Coexisting disease			
No	262.8	34.0	32.5
Yes	264.3	36.3	33.7
<i>P</i> -value	n.s.	n.s.	n.s.
History			
Primary	252.4	34.5	31.8
Recurrent	342.5	39.4	42.1
<i>P</i> -value	<b>0.020</b>	n.s.	<b>0.013</b>
Defect size (cm)			
≤2	214.4	29.8	29.2
≥3	354.3	38.3	42.4
<i>P</i> -value	<b>0.001</b>	n.s.	<b>0.002</b>
Intravenous sedation			
Light	247.2	33.5	31.5
Moderate	432.0	49.6	51.2
<i>P</i> -value	<b>0.0001</b>	n.s.	<b>0.0001</b>
Duration in operation room (min)			
≤60	218.1	36.7	26.8
≥61	316.2	33.6	37.4
<i>P</i> -value	<b>0.000</b>	n.s.	<b>0.001</b>

Bold values indicate statistical significance

recent papers present high-level evidences in favor of mesh repair [2, 11]. We routinely use meshes in umbilical hernia repair. Therefore, we could not present comparative data regarding the benefit of mesh use. Nevertheless, this recurrence-free 100-case series with close follow-up may also support the use of meshes.

Although obesity and larger defects have not generally been found to be related to recurrence [16, 17], some authors have accused higher BMI and larger defects to be factors for recurrence after umbilical hernia repairs [18, 19]. In the present series, it was not possible to analyze these two factors regarding recurrence. The number of

**Table 3** Wound complications

Surgical site infection	3
Hematoma	3
Seroma	3
Allergy to adhesive band	1
Ecchymosis	1
Total	12*

\* Two complications in one patient

cases with wound infection was also very small for a meaningful statistical analysis. However, higher BMI ( $\geq 25$ ) and larger defects ( $\geq 3$  cm) were found to correlate with higher local anesthetic requirement during repair. We previously reported similar findings for inguinal hernia repairs [6]. Another similarity between umbilical and inguinal hernias during repair with local anesthesia is whether the hernia is primary or recurrent. Recurrent hernias required larger local anesthetic volumes in the repair of both types of hernias.

In fact, the dose of local anesthetic agents required for umbilical hernia repair has not previously been evaluated. Kurzer et al. [7] reported that they used 0.25% bupivacaine plain without mentioning the exact doses. Menon and Brown [8] described a 40-ml mixture consist of 20 ml 1% xylocaine in 1/200,000 adrenaline and 20 ml 0.5% bupivacaine. The mean total volume of local agents was 33 ml in the present series. This is obviously higher than the mean total volume used for inguinal hernia repair in our previous report [6]. This difference might be caused by the anatomical unfamiliarity. A step-by-step local infiltration technique is, somewhat, a blockade of regional nerves. A 6–8-ml bupivacaine injection under the external oblique aponeurosis facilitates the further surgical manipulation in the inguinal region. In contrast, the periumbilical region does not have a similar sensitive innervation. It is not possible to block the sensation of pain without infiltrating all of the area dissected. It is interesting that even umbilical hernias with a defect smaller than 2 cm required a larger local anesthetic volume than inguinal hernias.

Age was reported as a significant factor for local anesthetic volume in inguinal hernia repair [6]. However, it did not affect the local anesthetic volume in umbilical hernia repair. This may be related to the stronger muscular structure of the inguinal region in younger individuals. Umbilical hernia repair is carried out over the fascial structures and the abdominal muscles do not restrict the surgical exposure during dissection and mesh placement.

We found that higher lidocaine doses were used with higher levels of sedation in some cases. In other words, higher doses of intravenous anesthetics for sedation did not decrease the dose of local anesthetics. Intravenous sedation could provide on-table patient comfort, but analgesia for

surgical manipulation can still be set with proper local infiltration.

Coexisting diseases usually create a risk for general anesthesia. Local anesthesia especially is a good option for those patients with concomitant diseases and patients with ASA score III and IV. The incidence of concomitant disease was also very high in the present series. Some patients even had three coexisting diseases. Many of them were referred by other institutions for the local anesthesia facility in our center. These patients were also treated with no procedure-related complications and discharged mostly on planned time, except for some patients with hypertension. No readmission was recorded in these high-risk patients. The doses of local anesthetic agents also did not show any differences with the patients who had no comorbidity. These results supported the use of local anesthesia for hernia repair in patients with coexisting disease once more.

Early discharge, low unplanned overnight stay, and low readmission rates are the major goals of day-case surgery. Besides hernia repairs, many other surgical procedures can be achieved on a day-case setting [20–22]. The mean discharge time was 122 min in the present series. Somewhat longer mean postoperative stays have previously been reported by Arroyo et al. (171 min) and Zuvella et al. (4 h) [23, 24]. Arroyo et al.'s [23] prosthetic umbilical hernia repair series with local anesthesia and sedation in a day-surgery unit resulted in 5.6% unplanned overnight stay and 5.6% delay in discharge ( $>6$  h). A 2% readmission rate was reported by Briggs et al. after day-case laparoscopic cholecystectomy [22]. Kurzer et al. [7] reported no readmission after prosthetic umbilical hernia repair using local anesthesia in 73 patients. Sanjay and Woodward [25] similarly reported a 2.7% readmission rate after inguinal hernia repair with local anesthesia. Most of their overnight stays were social admission. The only overnight stay in the present series was due to social reasons as well. Although we previously reported two readmissions following inguinal hernia repair in the same institution, no readmission was recorded after umbilical hernia repairs.

Some known reasons for readmission and difficulty in early discharge are nausea, vomiting, and severe postoperative pain. The first two problems were not observed in the present series. Also, no severe pain was recorded, although as high as 20% severe and 60% moderate pain rates have been reported for different day-case procedures in the literature [26–29]. Local anesthesia in day-case hernia surgery has pre-emptive effects, which results in low postoperative pain and early discharge after surgery.

On the other hand, Bellani stated that the essential component of anxiety management during surgical treatment is information provision [30]. The lack or inadequacy of information is one of the main complaints with day-

surgery and the most common cause of patient dissatisfaction. Low readmission rates achieved in day-surgery centers like ours are probably a result of combined surgical and interpersonal skills of the whole team.

Local wound complications following the prosthetic repair of umbilical hernias with local anesthesia are mainly seroma and hematoma. Each complication was observed in three cases in the present series. Stabilini et al. reported three seromas, one hematoma, and one prosthetic infection in 64 cases [31]. Naturally, umbilicus is not a clean anatomical part of the body. The umbilical skin may not even be cleaned of all bacteria, even with modern iodophor solutions. Therefore, surgical site infection can be more frequent after an umbilical hernia repair than after an inguinal hernia repair. A recent study reported a 19% infection rate following open umbilical hernia repair [32]. A 10% superficial wound infection rate is not surprising, even after routine prophylactic antibiotic use [7, 33]. Deysine recommended topical gentamicin in addition to preoperative intravenous prophylaxis to lower the infection rates after hernia repairs [34]. He reported no surgical site infections in hernia surgery after setting this prophylaxis combination for 24 consecutive years. Although gentamicin is most effective against Gram-negative bacteria, it also has killing activity against staphylococci. It has been stated that gentamicin can show antimicrobial synergy with cefazolin for a more successful antibacterial effect [34]. No wound infection developed in the present series in cases where topical gentamicin was applied, but no significant effect appeared in the statistical analysis. Topical gentamicin use seemed to have a possible benefit; however, controlled studies are needed.

In conclusion, the repair of umbilical hernias with local anesthesia in a day-case setting is a good option, with low infection and recurrence rates. Most patients can be discharged early as planned. Separate doses and the total volume of local anesthetic agents needed for umbilical hernia repair are clearly higher than those used in inguinal hernia repair. Patients with higher BMI, recurrent hernia, and defects larger than 3 cm may require higher local analgesic doses. Patient satisfaction is very good when they are provided with detailed information about day-surgery and local anesthesia.

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