

Evaluation of Four-Hand Reduction for Obturator Hernia with the Guidance of Sonography (FROGS) As a New Treatment Strategy for Obturator Hernia: A Single-Center Study

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Abstract

Background

Obturator hernia is an uncommon but important cause of intestinal obstruction. Delayed treatment can be fatal. Emergency surgery is considered the most effective treatment; however, patients with obturator hernia usually have comorbidities, which precludes them from emergency surgery. This study aimed to evaluate the effectiveness of Four-hand Reduction for Obturator hernia with the Guidance of Sonography (FROGS) as a new treatment strategy for obturator hernia.

Methods

Since November 2019, we have tried FROGS in all patients with obturator hernia at the emergency room. All the patients were female. We retrospectively compared the clinical data of 14 patients who underwent FROGS (after-FROGS group) with those of 23 patients who did not (before-FROGS group).

Results

No significant differences were observed in age, lesion side, duration of symptoms, the diameter of the prolapsed bowel, and predisposing factors. The body mass index was significantly lower in the after-FROGS group than in the before-FROGS group. Manual reduction was successfully performed in all 14 patients in the FROGS group, whereas in the before-FROGS group, 14 patients underwent manual reduction, of whom only one was successfully treated using the non-FROGS method. Bowel resection was avoided in all 14 patients in the after-FROGS group, whereas 8 patients underwent bowel resection in the before-FROGS group. There were no significant differences in postoperative complications and mortality within 30 days after hernia presentation between the two groups.

Conclusion

Manual reduction with FROGS was found to be safe and reproducible and can be the first treatment choice for obturator hernia.

Background

Obturator hernia is a rare type of abdominal hernia that accounts for < 1% of all abdominal hernias [1]. Although arriving at a definite preoperative diagnosis was difficult in previous years, it has become easy following the use of advanced imaging techniques [2–4, 5]. Obturator hernia usually develops in elderly, thin, and multiparous women who often have comorbidities and other debilitating conditions, which can preclude them from emergency surgery; therefore, the postoperative mortality rate after emergency surgery is high [6, 7]. However, once diagnosed, emergency surgery is usually performed because delayed treatment can lead to intestinal ischemia and subsequently, perforation [1]. Few reports have described a successful manual reduction of obturator hernia [8–10]. There is no controversy about whether manual reduction (with or without elective surgery) or emergency surgery is more effective, since many general surgeons believe that emergency surgery is the only effective treatment for this condition. Four-Hand Reduction for Obturator Hernia with the Guidance of Sonography (FROGS) is a simple technique that we devised to treat obturator hernia in the emergency room. This study was performed to evaluate the effectiveness of FROGS as a new treatment strategy for obturator hernia.

Methods

Study design

The clinical data of all patients with obturator hernia who were admitted to the Department of Surgery at Kurashiki Central Hospital between April 2016 and September 2020 were retrospectively reviewed. We implemented FROGS in the emergency room as the first choice of treatment since November 2019. We compared the clinical data (age, sex, body mass index, site of the hernia, predisposing factors, type of surgery, hernia size, complications, hospital stay, outcome, and follow-up) of patients who underwent FROGS (after-FROGS group) with those of patients who did not (before-FROGS group).

Steps of FROGS

FROGS is a bed-side reduction method in the emergency room for obturator hernia under real-time sonography guidance. This technique requires two surgeons, which is why it is a “four-hand” technique. Before initiating this procedure, the presence of obturator hernia (a hernia sac between the adductor longus and the pubis) has to be confirmed. While the surgeon confirms its presence, the assistant supports the patient to keep the hip joint flexed and rotated externally so that the hernia sac can be visualized (Fig. 1).

Step 1: The surgeon places the transducer in the left hand on the patient’s groin area (just cranial to the inguinal ligament) while the right hand pushes the hernia sac. Meanwhile, the assistant places the hip and knee joints in the flexed position.

Step 2: The assistant slightly rotates the hip joint laterally, thereby widely opening the hernia orifice (Fig. 2).

Step 3: The assistant places the hip joint and the knee joint in an extended position (Fig. 3).

To facilitate these movements, the assistant places one hand on the patient’s upper thigh and the other on the patient’s lower thigh. While the assistant performs the three-step maneuver, the surgeon has to keep pushing the hernial sac. In Step 3, the surgeon pushes it even harder. The muscles along the

obturator canal relax so that the hernia sac can be reduced. Two people continue this maneuver repeatedly until the hernia sac is completely pushed back. This movement may be reminiscent of a frog moving his legs while swimming, which is another reason the method is called "FROGS."

Statistical analyses

All statistical analyses were performed using R version 4.0.3. The continuous variables are expressed as the mean \pm standard deviation, and the categorical variables are expressed as absolute numbers and percentages. All variables were analyzed using Student's t-test for continuous variables and the χ^2 test or Fisher's exact test for categorical variables. A p value < 0.05 was considered statistically significant.

Results

A total of 37 patients with obturator hernia were admitted to the Department of Surgery at Kurashiki Central Hospital between April 2016 and September 2020. Until FROGS was implemented, 23 patients were already admitted (before-FROGS group). After November 2019, 14 patients were admitted, all of whom underwent FROGS as the first treatment choice (after-FROGS group). The demographic characteristics of all the patients are summarized in Table 1 at the end of this article.

Table 1 Demographic characteristics of the 37 patients with obturator hernia

Patient No	FROGS	Age	BMI	Duration of symptoms(Days)	Hospital stay (Days)	Prolapsed bowel diameter (cm)	Sex	Preoperative diagnosis	Site of lesion	Manual reduction	Emergency surgery	Operation performed
1	before-FROGS	88	17.9	2	8	2.39	F	Yes	Left	Not tried	Yes	TAPP repair
2	before-FROGS	87	17.1	0	6	2.14	F	Yes	Right	Not tried	Yes	inguinal approach
3	before-FROGS	93	13.0	1	22	1.96	F	Yes	Left	Not tried	Yes	inguinal approach
4	before-FROGS	87	17.1	2	5	2.26	F	Yes	Left	Unsuccessful	Yes	inguinal approach
5	before-FROGS	92	19.8	1	5	2.15	F	Yes	Right	Unsuccessful	Yes	inguinal approach
6	before-FROGS	84	17.3	1	9	2.61	F	Yes	Right	Unsuccessful	Yes	inguinal approach
7	before-FROGS	102	18.1	0	4	2.56	F	Yes	Left	Unsuccessful	Yes	inguinal approach
8	before-FROGS	80	14.2	1	9	1.84	F	Yes	Right	Not tried	Yes	inguinal approach
9	before-FROGS	91	16.3	0	20	1.57	F	Yes	Right	Not tried	Yes	inguinal approach
10	before-FROGS	78	14.2	2	46	2.89	F	Yes	Left	Unsuccessful	Yes	inguinal approach
11	before-FROGS	96	18.5	3	6	3.41	F	Yes	Right	Unsuccessful	Yes	inguinal approach
12	before-FROGS	93	17.3	4	15	3.43	F	Yes	Right	Not tried	Yes	inguinal approach
13	before-FROGS	90	19.5	1	12	2.43	F	Yes	Left	Unsuccessful	Yes	inguinal approach
14	before-FROGS	88	16.2	0	8	2.45	F	Yes	Right	Not tried	Yes	inguinal approach
15	before-FROGS	84	17.9	2	3	3.17	F	Yes	Left	Successful	No	TAPP repair
16	before-FROGS	82	13.5	7	41	1.65	F	Yes	Right	Unsuccessful	Yes	inguinal approach
17	before-FROGS	88	16.0	1	2	2.3	F	Yes	Right	Not tried	Yes	TAPP repair
18	before-FROGS	88	19.2	1	7	1.6	F	Yes	Right	Unsuccessful	Yes	laparotom
19	before-FROGS	90	18.3	1	6	2.1	F	Yes	Right	Unsuccessful	No	-
20	before-FROGS	92	18.7	3	27	2.11	F	Yes	Left	Unsuccessful	Yes	inguinal approach
21	before-FROGS	85	19.3	1	7	2.32	F	Yes	Left	Unsuccessful	Yes	TAPP repair
22	before-FROGS	81	17.6	0	23	2.11	F	Yes	Right	Not tried	Yes	TAPP repair
23	before-FROGS	93	26.5	1	8	2.51	F	Yes	Left	Unsuccessful	Yes	laparotom
24	after-FROGS	90	12.8	3	3	1.98	F	Yes	Left	Successfu	No	TAPP repair
25	after-FROGS	97	17.4	2	11	2.81	F	Yes	Right	Successfu	No	-
26	after-FROGS	82	16.3	0	2	2.85	F	Yes	Left	Successfu	No	TAPP repair
27	after-FROGS	90	24.3	0	16	3.18	F	Yes	Right	Successfu	No	TAPP repair
28	after-FROGS	91	14.2	2	4	2.57	F	Yes	Left	Successfu	No	-

29	after-FROGS	85	16.1	3	12	2.64	F	Yes	Right	Successful	No	-
30	after-FROGS	98	17.3	0	7	3.17	F	Yes	Right	Successful	No	TAPP repair
31	after-FROGS	76	13.0	3	7	1.64	F	Yes	Right	Successful	No	-
32	after-FROGS	76	13.0	3	7	1.54	F	Yes	Left	Successful	No	-
33	after-FROGS	92	19.6	0	3	3.24	F	Yes	Left	Successful	No	-
34	after-FROGS	92	14.2	0	6	2.61	F	Yes	Left	Successful	No	-
35	after-FROGS	82	13.1	0	3	3.03	F	Yes	Left	Successful	No	-
36	after-FROGS	82	15.4	0	4	2.75	F	Yes	Left	Successful	No	TAPP repair
37	after-FROGS	91	17.3	1	6	2.47	F	Yes	Right	Successful	No	TAPP repair
BMI=body mass index, DM=diabetes mellitus, CKD=chronic kidney disease, TAPP=transabdominal preperitoneal												

All patients were female. Obturator hernia was diagnosed in all 37 patients preoperatively based on a computed tomography scan. There were no significant differences in age, lesion side, duration of symptoms, the diameter of the prolapsed bowel, and predisposing factors between the two groups. Body mass index was significantly lower in the after-FROGS group than that in the before-FROGS group ($p = 0.0158$, Table 2).

Table 2
Comparison of two groups at the first visit

	before-FROGS	after-FROGS	P value
Age	88.3 ± 5.53	87.4 ± 7.01	0.660
BMI	17.5 ± 2.73	16.0 ± 3.17	0.016
Duration of symptoms (days)	1.52 ± 1.59	1.21 ± 1.37	0.541
Prolapsed bowel (cm)	2.35 ± 0.51	2.61 ± 0.54	0.152
Site of Lesion (Right/Left)	13/10	6/8	0.420
Predisposing factors			
Cardiopathy	8 (34.8%)	4 (28.6%)	1.000
Vascular disease	5 (21.7%)	3 (21.4%)	1.000
Hypertension	9 (39.1%)	5 (35.7%)	1.000
Lung disease	3 (13.0%)	0 (0%)	0.275
DM	1 (4.3%)	1 (7.1%)	1.000
CKD	4 (17.4%)	0 (0%)	0.276
Dementia	1 (4.3%)	2 (14.3%)	0.544
Manual reduction (successful/tried)	14/14 (100%)	1/14 (7.14%)	< 0.001
Number of patients who went on emergency surgery	0 (0%)	21 (91.3%)	< 0.001
BMI = body mass index			

All 15 elective surgeries in both the groups were performed using laparoscopic repair (transabdominal preperitoneal repair, TAPP repair). On the contrary, out of 21 patients who underwent emergency surgeries, only 4 (19.0%) underwent laparoscopic repair (TAPP). The rate of TAPP was significantly higher in patients who underwent elective surgery ($p < 0.001$, Table 3).

Table 3
Comparison of elective surgery and emergency surgery for operative method

	elective surgery	emergency surgery	p value
TAPP/inguinal approach or laparotomy	15/0	4/17	< 0.001
TAPP = transabdominal preperitoneal			

Manual reduction was successfully performed in all 14 patients in the FROGS group (success rate of 100%). In the before-FROGS group, 14 patients underwent manual reduction, of whom only one was successfully treated (success rate of 7.14%) using the non-FROGS method. The success rate of manual reduction was significantly higher in the after-FROGS group than in the before-FROGS group ($p < 0.001$, Table 2).

Of the 14 patients in the after-FROGS group, six underwent elective surgery. All six operations were performed using TAPP. Eight patients did not undergo elective surgery because of comorbidities. In the before-FROGS group, the successful manual reduction was performed in only one patient who underwent elective surgery, which was performed using TAPP. Emergency surgery could not be performed on one patient because of severe heart failure; this patient died 6 days after admission. The other 21 patients underwent emergency surgery: 17 underwent laparotomy and 4 underwent TAPP. The number of patients who underwent emergency surgery was significantly smaller in the after-FROGS group than in the before-FROGS group ($p < 0.001$, Table 2).

Bowel resection could be avoided in all 14 patients in the after-FROGS group, whereas 8 patients underwent bowel resection in the before-FROGS group. The bowel resection rate was significantly lower in the after-FROGS group than in the before-FROGS group ($p = 0.015$, Table 4). No significant differences were observed in postoperative complication and mortality rates within 30 days after hernia presentation between the two groups.

Table 4
Comparison of the two groups for operative and postoperative data

	before-FROGS	after-FROGS	P value
Bowel resection	8 (34.8%)	0 (0%)	0.015
Postoperative complication	7 (30.4%)	1 (7.14%)	0.123
Death in 30 days after admission	2 (9.5%)	0 (0%)	0.517

Discussion

Obturator hernia is a rare type of abdominal hernia. Its pathogenesis is attributed to the loss of preperitoneal fat and lymphatic tissues, which normally overlie the obturator canal, thus creating a space around obturator vessels and nerves [11]. Concomitant illnesses, such as chronic obstructive pulmonary disease, constipation, and kyphoscoliosis could result in increased intraperitoneal pressure and facilitate the growth of the hernia sac [12]. Lean and elderly women are usually affected as they have less preperitoneal fat and several comorbidities, which favor the pathogenesis of this condition.

Laparotomy is the standard approach for the treatment of obturator hernia, since preoperative diagnosis is difficult owing to its rarity and non-specific signs and symptoms. Ziegler et al. have mentioned that “Obturator hernia needs a laparotomy, not a diagnosis” [13]. Likewise, many surgeons believe that emergency laparotomy is the most optimal treatment for possible incarcerated obturator hernias. However, recent advances in imaging techniques, such as computed tomography and ultrasonography, have improved the rate of correct preoperative diagnosis, which has made less invasive approaches feasible to undertake [2–4]. Few studies have described less invasive therapeutic strategies, such as elective surgeries following successful manual reduction [5–7]. Elective surgeries were shown to be associated with a higher rate of TAPP implementation. The reason for undertaking laparoscopic approaches less frequently in emergency surgeries could be attributed to the smaller peritoneal cavity resulting from a dilated intestine.

This study aimed to evaluate the efficacy of FROGS as the first choice of treatment for incarcerated obturator hernias. Usually, patients with obturator hernia have comorbidities, which makes them unsuitable for emergency surgeries. They should be treated with less invasive therapy in an elective setting, if possible. In addition, it is often the case that some patients and their families do not consent to surgery. Ceresoli et al. showed that emergency surgery for complicated inguinal hernias is burdened by high morbidity and mortality rates in elderly patients [14]. For patients with asymptomatic or minimally symptomatic inguinal hernias, watchful waiting is recognized as an acceptable option [15, 16]. Although these studies have mainly focused on inguinal hernias, the results could apply to obturator hernias as well.

In our study, emergency surgeries could be avoided in asymptomatic or minimally symptomatic patients because of the implementation of FROGS. Some of these patients underwent safe elective TAPP repair, while in others, comorbidities or family wishes were decisive factors. Irrespective of whether elective surgery was performed or not, bowel resection could be avoided in all patients. In addition, the short-term prognosis between the after-FROGS and before-FROGS groups was comparable. Although the balance between the risks of elective surgery versus the risks of a watchful approach is still a matter of debate in the absence of specific recommendations for elderly patients [14], a watchful approach could be a choice based on this result and the literature.

Although patients who do not undergo elective surgery are still at risk of recurrence, FROGS can be reproducible in cases of recurrence owing to its high success rate. Therefore, we believe that FROGS can be the first choice of treatment in any case of obturator hernia incarceration. The mechanism of FROGS is unclear and may be complex. However, we believe that complex coordinated movements of muscles around the obturator canal may have an important role. The driving pressure generated by these movements helps surgeons to reduce the hernia sac. In addition, at some point during this maneuver, the obturator canal may be maximally relaxed (usually in Step 3, based on our experience), and by repeating FROGS, we can eventually find this particular point.

The necessity of bowel resection is hard to decide, especially if FROGS is implemented. No patients in the after-FROGS group required bowel resection. The longest duration from symptom onset to hernia presentation was 72 hours. Based on this result, we can argue that if there is no obvious evidence of strangulation or ischemia, a manual reduction by FROGS is acceptable within 72 hours.

The limitation of this study is the relatively small sample size. Further observations and analyses are necessary to confirm the effectiveness of FROGS. Notwithstanding these limitations, manual reduction with FROGS was found to be safe and reproducible and can be the first treatment choice for obturator hernia. FROGS can be used instead of emergency surgery as a less invasive method to treat patients with obturator hernia while preserving the bowel.

Conclusion

This study was performed to evaluate the effectiveness of FROGS as a new treatment strategy for obturator hernia. Based on retrospective data of 37 patients, which includes 14 patients who went through FROGS (after-FROGS group) and 23 patients who did not (before-FROGS group), FROGS was found to be safe and reproducible and can be the first treatment choice for obturator hernia, instead of emergency surgery. More observations and analyses are necessary to further discuss the scope of the indication of FROGS since the sample size is relatively small. However, we believe this result is quite promising.

Abbreviations

FROGS
Four-hand Reduction for Obturator hernia with the Guidance of Sonography
TAPP repair
transabdominal preperitoneal repair
BMI
body mass index
DM
diabetes mellitus,
CKD
chronic kidney disease

Declarations

Ethics approval and consent to participate: All procedures performed in this study, which involved human participants, were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed consent was obtained for the academic usage of patients' photographs.

Consent for publication: Written informed consent was obtained for the academic usage of patients' photographs.

Availability of data and material: Not applicable.

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

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Authors' contributions: All authors contributed to the study conception and design. YT and KK performed material preparation, data collection, and data analysis. YT wrote the first draft of the manuscript, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Figures

Fig. 1

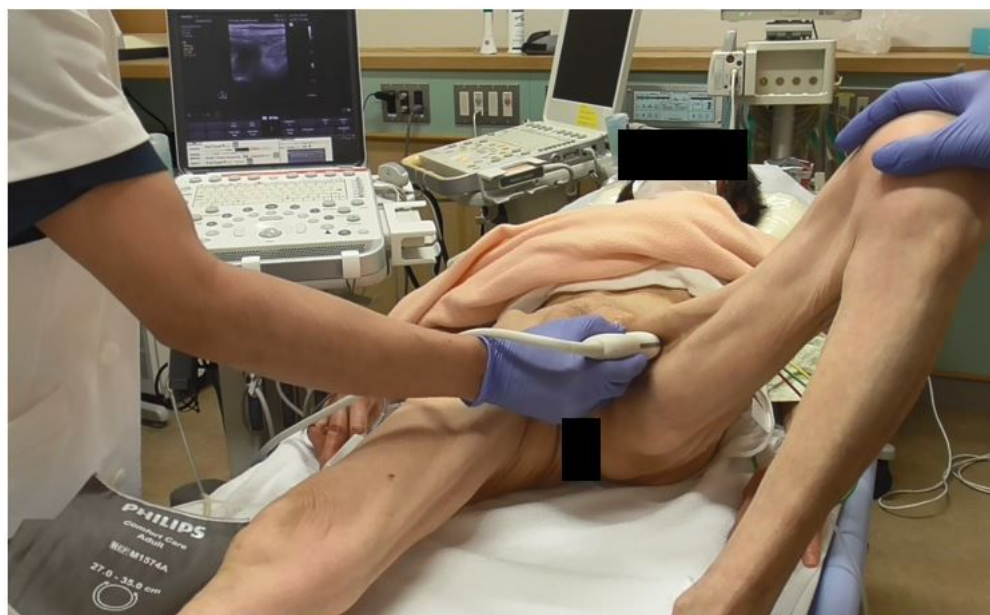


Figure 1

The surgeon is confirming the hernia sac between the adductor longus and the pubis. The assistant supports the patient to keep the hip joint flexed and rotated externally to ensure the hernia sac is well-visualized.

Fig. 2



Figure 2

STEP 1 to STEP 2. The surgeon places the transducer in the left hand on the patient's groin area (just cranial to the inguinal ligament) while the right hand pushes the hernia sac. Meanwhile, the assistant places the hip joint and the knee joint in the flexed position. Subsequently, the assistant slightly rotates the hip joint laterally, thereby widely opening the hernia orifice.

Fig. 3



Figure 3

The assistant places the hip joint and the knee joint in an extended position.