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CASE REPORT

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ABOUT COVER

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The primary aim of *World Journal of Surgical Procedures* (*WJSP*, *World J Surg Proced*) is to provide scholars and readers from various fields of surgical procedures with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJSP mainly publishes articles reporting research results and findings obtained in the field of surgical procedures and covering a wide range of topics including ablation techniques, ambulatory surgical procedures, surgical anastomosis, assisted circulation, bariatric surgery, biopsy, bloodless medical and surgical procedures, non-therapeutic body modification, cardiovascular surgical procedures, curettage, debridement, surgical decompression, deep brain stimulation, device removal, digestive system surgical procedures, dissection, *etc*.

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CASE REPORT

Cemento-ossifying fibroma of the left mandible: A case report

I Nengah Wiadnyana Steven Christian, Michael, Kelvin Setiawan

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Abstract

BACKGROUND

Ossifying fibroma is a type of benign fibro-osseous lesion. Most lesions affect the mandible region, particularly the molar and pre-molar areas. It predominantly affects females between the second to fourth decades of life. Larger ossifying fibroma tumors require more extensive resection.

CASE SUMMARY

A 39-year-old female complained of occasional pain and tumor enlargement on her left jaw for the 3 years prior to presentation. Intraoral examination revealed a firm swelling on her left lower gum. Extraoral examination revealed swelling on the left mandible body with no erythema and superficial ulcer. Computed tomography scan revealed a circular-shaped lesion on the patient's left mandible body with a well-defined radiolucent border, sized 3.2 cm × 2.8 cm × 0.9 cm. The tumor was removed by marginal mandibulectomy. Biopsy from the resected tumor suggested cemento-ossifying fibroma (COF).

CONCLUSION

COF is often unnoticed, but this slow-growing tumor can cause significant symptoms regarding its distortion into adjacent structures.

Key Words: Cemento-ossifying fibroma; Ossifying fibroma; Mandible; Marginal mandibulectomy; Biopsy; Case report

Core Tip: Ossifying fibroma is a benign fibro-osseous lesion that predominantly affects the craniofacial region. It is considered a rare tumor, with most lesions affecting the mandible region, particularly the molar and pre-molar areas. It is asymptomatic in most cases, but it can slowly grow until it is involved with the adjacent structures, leading to symptoms. The treatment is surgical excision, and it can be safely performed due to its well-demarcated nature. Recurrences can be avoided by extensive removal of the tumor. This case highlighted a case of a rare tumor with surgical excision and a good outcome.

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INTRODUCTION

Ossifying fibroma is a benign fibro-osseous lesion based on Waldron's classification, which predominantly affects the craniofacial region[1]. It is considered a rare tumor, with most lesions affecting the mandible region, particularly the molar and pre-molar areas. It predominantly affects females with an incidence of 5:1 ratio compared to males and is commonly encountered between the second to fourth decade of life. It has characteristics of a slow-growing tumor, sometimes asymptomatic and expansive, which if left untreated may lead to signs and symptoms caused by an enlarged mass and significant involvement to the adjacent vital structures[2]. During its early stage, the tumor may appear small and well-demarcated, which can be safely enucleated. However, larger tumors require more extensive resection, in which reconstructions are sometimes needed[3]. In this study, we reported the clinical presentation of a cemento-ossifying fibroma (COF) on the patient's left mandible, which was treated with lip-splitting incision and tumor excision through marginal mandibulectomy. This study aimed to share our experience with mandible COF and associated surgical approach.

CASE PRESENTATION

Chief complaints

A 39-year-old female patient complained of occasional pain in her left jaw for the 3 years prior to presentation. Shortly after, the patient noticed a small tumor on her gum, precisely below the first pre-molar tooth on her left mandible.

History of present illness

The tumor was slowly growing in size, and the pain frequency had increased more than before. The patient had no other comorbidities. The patient had undergone a panoramic radiographic examination, which revealed a singular, well-demarcated, circle-shaped lesion in the left mandible body below the second molar and first pre-molar teeth. Based on patient's perspective, she felt that the tumor did not increase in size since her latest visit to the dentist.

History of past illness

The patient had no history of trismus and difficulty in masticating, although pain occasionally emerged during eating.

Personal and family history

The patient did not have any previous medical conditions or other family history.

Physical examination

Intraoral examination revealed a firm swelling on her left lower gum, precisely below her previously drilled first pre-molar tooth. Mild tenderness was observed on percussion, but no tooth mobility was encountered. There was minimal swelling on the left mandible body with no erythema, superficial ulcer, and no other facial asymmetry on the extraoral examination. When palpated, the tumor was fixated with hard consistency, similar to bone (Figure 1).

Laboratory examinations

A routine blood test was performed, and the results were within normal limits.

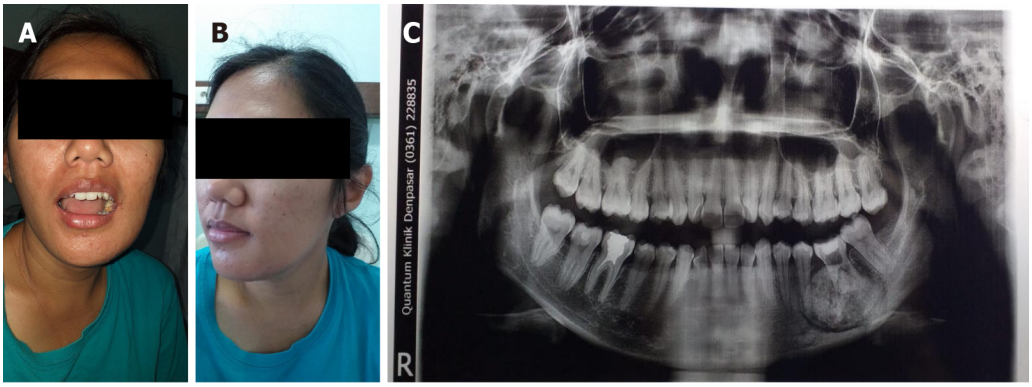

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Figure 1 Physical examination images. A and B: The patient's clinical presentation with a firm swelling on her left gum below the first pre-molar tooth and minimal swelling on the left lower jaw; C: A panoramic radiographic image revealed a singular, well-demarcated, circular lesion in the left mandible body.

Imaging examinations

A computed tomography (CT) scan with 3D reconstruction revealed a circular-shaped lesion on the patient's left mandible body with a well-defined radiolucent border between the lesion and surrounding normal bone, sized 3.2 cm × 2.8 cm × 0.9 cm (Figure 2). Fine-needle aspiration biopsy from the tumor suggested COF of the mandible. Based on these results, the patient was scheduled to undergo tumor removal with marginal mandibulectomy.

FINAL DIAGNOSIS

The final diagnosis of the presented case was COF of the mandible.

TREATMENT

The patient was then admitted 2 d prior to the elective surgical procedure. On the operation day, the patient was positioned supine with her head slightly tilted to the opposite side. The patient then underwent general anesthesia with nasotracheal intubation. Lip-splitting incision was performed and extended towards the patient's left angulus mandibulae. After the left mandible and the bony tumor were completely exposed, marginal mandibulectomy was performed. Marginal mandibulectomy was the preferred option in order to achieve 0.5 cm tumor margins. The periosteum was preserved to naturally construct the bone defects. Therefore, reconstruction will not be necessary in the future. Mandible plate fixation was not performed, as we maintained the integrity of the remaining mandible bone. Therefore, it will not cause soft tissue collapse, which we observed in the follow-up examinations. The wound was then washed with normal saline solution, minor bleeding was controlled, and drain insertion and wound closure using a subplatysmal flap were performed (Figure 3). The excised tumor was sent for pathology examination and described as an ossifying fibroma. From × 10 magnification, it showed the bone trabecular component and fibrous connective tissues along with fibroblast cell proliferation. From × 40 magnification, it showed spindle-shaped cells with cigar-shaped nuclei, eosinophilic cytoplasm, and smooth chromatin (Figure 4).

OUTCOME AND FOLLOW-UP

The patient had an uneventful postoperative clinical course with no postoperative complications. The drain was removed 3 d postoperative and showed no further rebleeding. At a follow-up visit 3 mo after the surgery, the pain was resolved, and she was asymptomatic. Panoramic radiographs were performed every 6 mo, and CT scan with 3D images were taken 1 year after surgery with satisfactory results without any recurrent lesions.

DISCUSSION

COF is a benign neoplasm that primarily affect the mandible and other craniofacial areas. COF consists

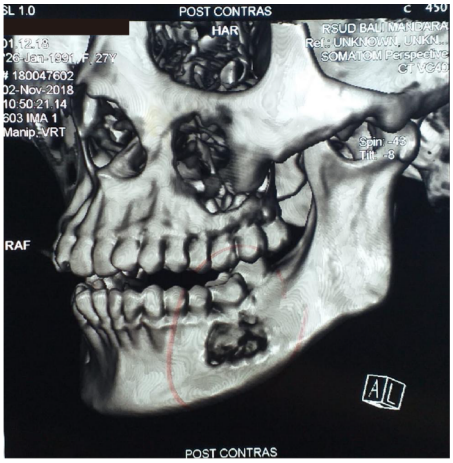

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Figure 2 Computed tomography scan with 3D reconstruction revealed a circular-shaped lesion in the left mandible body with a well-defined radiolucent border, sized 2.3 cm × 2.8 cm × 0.9 cm.

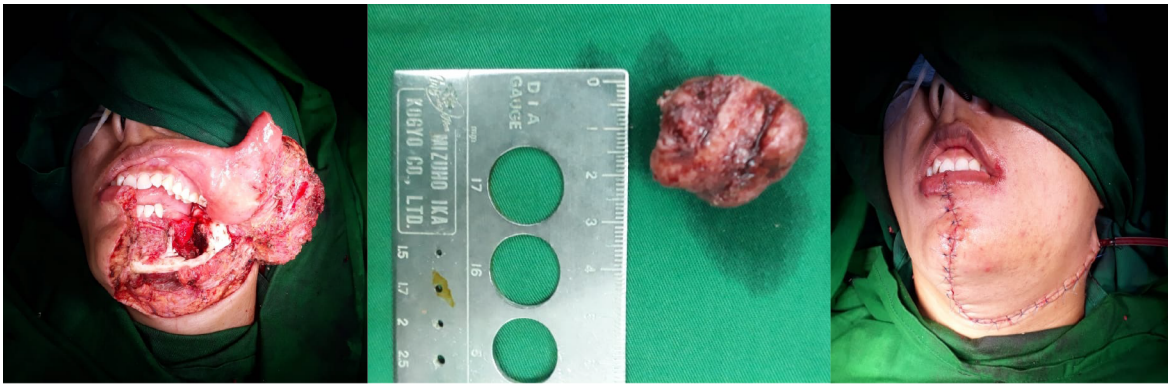

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Figure 3 Lip-split incision approach was used and continued with marginal mandibulectomy. Drain insertion was performed, and wound closure was carried out with a subplatysmal flap.

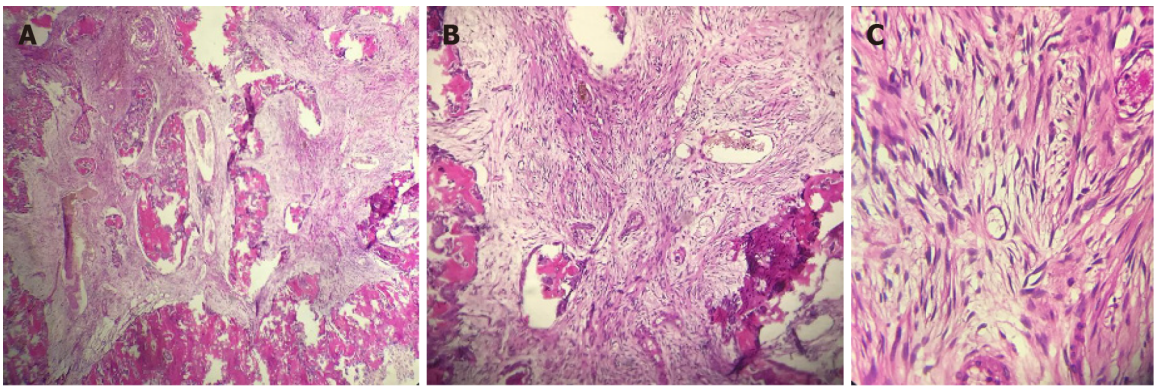

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Figure 4 Pathology examination images of the excised tumor. A and B: Tumor specimen under the microscope at × 10 magnification; C: Tumor specimen under the microscope at × 40 magnification. It showed the bone trabecular component and fibrous connective tissues with spindle-shaped cells with cigar-shaped nuclei, eosinophilic cytoplasm, and smooth chromatin.

of fibrous tissue, bone, and cementum in different proportions[1]. COF is one out of three variants of ossifying fibroma; the other variants are juvenile trabecular ossifying fibroma and juvenile psammomatoid ossifying fibroma[2]. These other variants reflect different demographics, their tendency to progress into malignant lesions, and their overall prognosis. The World Health Organization classifies

COF as one of the fibro-osseous neoplasms, part of non-odontogenic tumors originating from periodontal ligament mesenchymal blast cells. It can progress into fibrous tissue, bone, cementum, or a combination of all three, as mentioned before[3]. However, this theory is still debatable, pointing to recent microscopic studies of COF arising from frontal, sphenoid, temporal, and ethmoid bones[4].

COF is asymptomatic in most cases, starting as a small unidentified tumor but slowly grows until it becomes noticeable as a swelling on the patient's face and causes symptoms associated with its disturbance towards other structures. Due to its well-demarcated nature, enucleation and curettage of this lesion can be safely performed. However, larger lesions require more radical approaches, and inadequate surgical excision may result in recurrences[5]. One case report in 2021 by Guddadararangiah *et al*[6] presented a large mandible COF infiltrating parapharyngeal and infratemporal spaces, which required a hemi-mandibulectomy procedure. Another report in 2015 presented COF in a similar area to our case report but larger in size and treated with segmental mandibulectomy[7].

COF predominantly affects the mandible and commonly occurs in the molar and pre-molar areas. However, there were cases of COF found elsewhere other than the mandible area, such as in maxilla and orbital and ethmoidal regions. From a case series of 16 COF cases, 50% of these cases were found in the maxilla and the other 50% in the mandible region. There was 1 case of COF found in the right zygoma region with clinical presentation of diffuse swelling extending toward the upper vestibule[8]. Some COF cases in the maxilla region can cause facial deformities, sinus obstruction, and intraorbital and intracranial discomfort due to their involvement in adjacent structures. A recent report in 2020 presented a large, neglected COF of the maxilla region with a complaint of significant pressure on her left eye[4].

COF, regardless of its variant, location, and size, is a neoplasm that requires surgical excision. Depending on its size and location, treatment can be divided into conservative or radical surgery. While some authors reported no significant outcome between conservative and radical excision, others had suggested extensively removing the tumor, particularly aggressive lesions, to avoid any recurrences[5]. We preferred to extensively remove the tumor to avoid any recurrences in the future. A marginal mandibulectomy was a suitable option to remove the tumor adequately and safely. Lip-split incision was also preferred as a method of choice to expose the mandible adequately, as there are no significant differences in postoperative complications compared with the visor approach based on a retrospective review in 2018[9]. Marginal mandibulectomy was considered a feasible procedure, as the tumor had approached the mandible without infiltration toward tooth sockets and dental rehabilitation was not planned after surgery[10].

In other studies, all mandible COFs were treated locally. Kaur *et al*[8] in 2019 reviewed 16 maxillofacial COF cases, half of them affecting the mandible region. They found that 10 out of 16 cases were treated with enucleation and curettage, 5 cases were resected locally, and 1 case was resected en bloc with other involved structures. No patients developed any recurrences during follow-up observation. There were other studies in which the cases were managed extensively either by segmental or hemimandibulectomy due to massive size, and mandible plate reconstructions were performed[4-7]. One study reported a similar approach to our study, in which the tumor was safely excised with preservation of the inferior mandible border and without any reconstruction. Unfortunately, the outcome and follow-up reports were not mentioned[11].

One study interestingly preserved the mandible periosteum after large COF enucleation. They used periosteum osteogenesis potential to induce bone regeneration with a satisfactory result and no COF recurrence after 3 years of follow-up. It was based on the ability of the periosteum to act as a barrier to prevent soft tissue migration. Periosteum bone cells and its rich vascular supplies support adequate bone growth. With periosteum preservation, we can expect a bone restoration process from the post-excision defect area in our patient and reconstruction will not be necessary. However, Shirafkan *et al*[12] did reconstruct with mandible plate and screws.

CONCLUSION

COF is a benign neoplasm, usually asymptomatic, and predominantly affecting the mandible with a molar and pre-molar tooth as its predilected site. It is often unnoticed, but this slow-growing tumor can cause significant symptoms regarding its distortion into the adjacent structures. COF requires surgical excision, and larger tumors require a more extensive approach. Recurrences after removal are usually rare.

FOOTNOTES

Author contributions: Christian INWS and Setiawan K contributed to the conceptualization, design, and manuscript editing; Christian INWS and Michael are the guarantors of this study; All authors contributed to the definition of intellectual content, literature search, and review of the manuscript.

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REFERENCES

1 **Balaji SM**, Balaji P. Comparison of Midface Advancement by External and Internal Craniofacial Distraction Osteogenesis. *Ann Maxillofac Surg* 2018; **8**: 200-205 [PMID: 30693232 DOI: 10.4103/ams.ams_234_18]
2 **Nelson BL**, Phillips BJ. Benign Fibro-Osseous Lesions of the Head and Neck. *Head Neck Pathol* 2019; **13**: 466-475 [PMID: 30887390 DOI: 10.1007/s12105-018-0992-5]
3 **Darío SLJ**, Paolo C, Miguel PP, Fernando M, Ismael R. Denosumab Related Osteonecrosis of the Jaws as Consequence of Osteoporosis Treatment-A Case Series. *Saudi J Oral Dent Res* 2017; **2**: 215-219 [DOI: 10.1007/978-3-662-43733-9_9]
4 **Aburas S**, Bandura P, Al-Ibraheem A, Berger S, Meier M, Turhani D. A large maxillary cemento-ossifying fibroma superimposed with solitary bone cyst documented over 18 years: A case report. *Int J Surg Case Rep* 2020; **68**: 257-262 [PMID: 32199251 DOI: 10.1016/j.ijscr.2020.03.011]
5 **Katti G**, Khan MM, Chaubey SS, Amena M. Cemento-ossifying fibroma of the jaw. *BMJ Case Rep* 2016; 2016: bcr2015214327 [PMID: 27174452 DOI: 10.1136/bcr-2015-214327]
6 **Guddadararangiah S**, Ram Shetty S, Al-Bayatti S, Narasimhan S. Large cemento-ossifying fibroma of the mandible involving the infratemporal and parapharyngeal spaces. *Heliyon* 2021; **7**: e07594 [PMID: 34337187 DOI: 10.1016/j.heliyon.2021.e07594]
7 **da Silveira DT**, Cardoso FO, E Silva BJ, E Alves Cardoso CA, Manzi FR. Ossifying fibroma: report on a clinical case, with the imaging and histopathological diagnosis made and treatment administered. *Rev Bras Ortop* 2015; **51**: 100-104 [PMID: 26962494 DOI: 10.1016/j.rboe.2015.12.002]
8 **Kaur T**, Dhawan A, Bhullar RS, Gupta S. Cemento-Ossifying Fibroma in Maxillofacial Region: A Series of 16 Cases. *J Maxillofac Oral Surg* 2021; **20**: 240-245 [PMID: 33927492 DOI: 10.1007/s12663-019-01304-y]
9 **Cohen LE**, Morrison KA, Taylor E, Jin J, Spector JA, Caruana S, Rohde CH. Functional and Aesthetic Outcomes in Free Flap Reconstruction of Intraoral Defects With Lip-Split Versus Non-Lip-Split Incisions. *Ann Plast Surg* 2018; **80** (Suppl 4): S150-S155 [PMID: 29489537 DOI: 10.1097/SAP.0000000000001373]
10 **Shah JP**, Singh B, Patel SG, Wong RJ. Oral Cavity. In: Shah JP, Singh B, Patel SG, Wong RJ. Jatin Shah's Head and Neck Surgery and Oncology. 5th ed. Edinburg: Elsevier; 2020: 256-257
11 **Bala TK**, Soni S, Dayal P, Ghosh I. Cemento-ossifying fibroma of the mandible. A clinicopathological report. *Saudi Med J* 2017; **38**: 541-545 [PMID: 28439606 DOI: 10.15537/smj.2017.5.15643]
12 **Shirafkan S**, Gholamian M, Rohani A, Mahmoudinezhad SS, Razavi M, Moradi K. Complete Spontaneous Bone Regeneration following Surgical Enucleation of a Mandibular Cemento-Ossifying Fibroma. *Case Rep Dent* 2022; **2022**: 7902602 [PMID: 36034160 DOI: 10.1155/2022/7902602]

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CASE REPORT

Simple lateral elbow dislocation: A case report

Mehmet Albayrak

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Abstract

BACKGROUND

Simple lateral elbow dislocation (SLED) is a rare type of elbow dislocation; however, its treatment may be complicated by accompanying soft tissue or neurovascular damage. Herein, we report a rare case of SLED managed secondarily with open reduction and soft tissue repair following failure of closed reduction.

CASE SUMMARY

A 67-year-old woman suffered SLED after falling on her outstretched left hand with her elbow extended. She developed pain, swelling, and movement restriction in the elbow; there were no neurovascular symptoms, except for numbness in the 4th and 5th digits. Radiologic investigation confirmed the SLED, and a closed reduction under anesthesia was performed. The follow-up radiographs at 1-wk revealed failure of reduction; accordingly, open reduction with lateral collateral ligament and common extensor origin repair were carried out. The patient regained full elbow range of motion by six weeks.

CONCLUSION

Adequate concentric reduction for SLED, conservatively or surgically, reduces complications and provides a more functional joint.

Key Words: Common extensor origin; Elbow joint capsule; Lateral collateral ligament; Closed reduction; Open reduction; Fluoroscopy; Case report

Core Tip: Despite their rarity, the results of simple lateral elbow dislocations are gratifying if they are handled well from start to finish. Treatment may be terminated with closed methods or surgery may be required. Regardless of the method of treatment, the results are good with a close follow-up.

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INTRODUCTION

Elbow dislocation, the second most common joint dislocation in adults[1], frequently occurs in the posterior or posterolateral direction, whereas simple lateral elbow dislocation (SLED) is a rare entity, with only a handful of reports in the literature[1-3]. Simple dislocation involves pure articular disengagement without accompanying fractures, while dislocation with a concomitant fracture is called complex dislocation[4,5].

SLEDs are usually accompanied by neurovascular involvement[6,7] or soft tissue damage[8], which may hinder closed reduction[9-11] due to interposition of muscles (such as the anconeus and brachialis) or fracture fragments (if any). In this study, we report a rare case of SLED managed by open reduction and repair of the lateral collateral ligament (LCL) and common extensor origin performed one week after a failed closed reduction.

CASE PRESENTATION

Chief complaints

A 67-year-old right-hand dominant woman was admitted to the emergency room with elbow pain and inability to move her elbow on January 4, 2021 with a history of falling on an outstretched left hand with her elbow extended.

History of present illness

She presented with a swollen left elbow and her right hand holding her left wrist with a pronated forearm. She fell down while walking and was admitted to hospital within 20 min.

History of past illness

There is no history since this was an emergent case.

Personal and family history

Hypertension was her only chronic illness. There was no family history.

Physical examination

The patient's body temperature was 36.2 °C, heart rate 96 bpm, respiratory rate 24 breaths/min, blood pressure 140/90 mmHg, height 162.0 cm and weight 96 kg. There was no open wound around the elbow, as seen on the first examination. There were no signs of any distal circulatory disorder or neurological deficits in the left upper extremity, except for numbness in the left 4th and 5th digits.

Laboratory examinations

Complete blood count parameters were in the normal range.

Imaging examinations

Anteroposterior and lateral radiographs of the elbow revealed lateral displacement of both the ulna and radius relative to the humerus without a fracture (Figure 1).

FINAL DIAGNOSIS

Left SLED.

TREATMENT

Under sedation anesthesia in the operating room, a gentle closed reduction under fluoroscopy was performed. An assistant applied longitudinal traction to the humerus through the axilla, and the surgeon, while holding the forearm in supination, maneuvered it in the medial direction, as the assistant moved the humerus in the lateral direction. An audible click confirmed the correction of the dislocation which was also evident under fluoroscopy. After reduction, both passive flexion and extension range of motion (ROM) of the elbow were regained. The valgus stress test was normal, but the varus stress test performed at 25° elbow flexion was abnormal opening to about 20°. Next, a gravity-assisted varus stress test[12] was applied, which indicated a LCL deficiency. A concentric reduction was confirmed under fluoroscopic

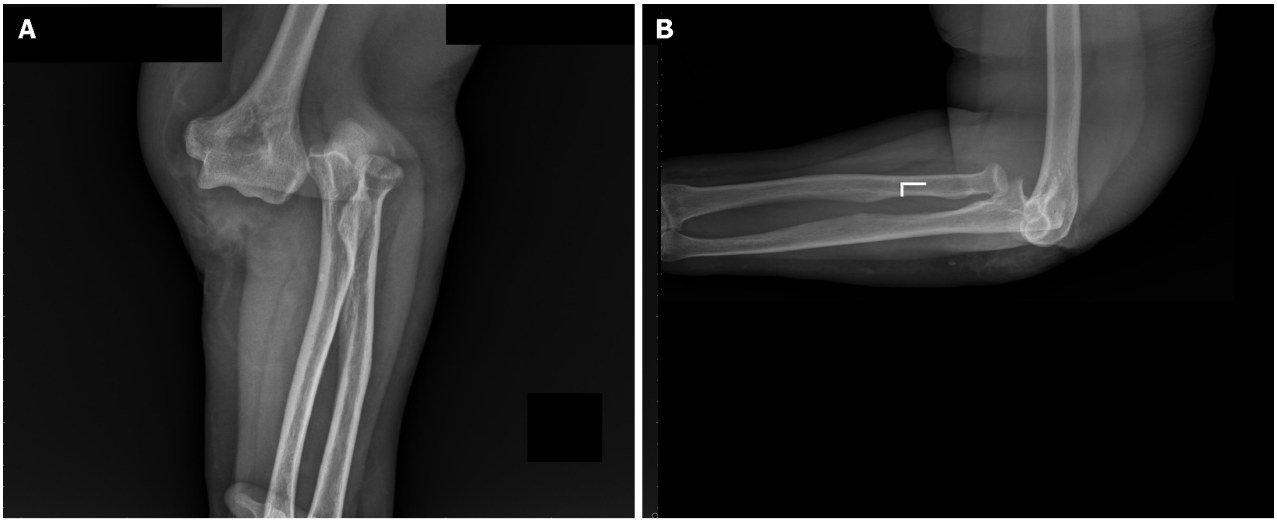

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Figure 1 Roentgenographs at the time of the injury. A: Anteroposterior; B: Lateral.

examination; afterward, we applied a long arm splint to immobilize the elbow in 90° flexion and neutral rotation, as LCL-deficient elbows are most unstable in supination[13,14]. When the patient woke up from anesthesia, she had no pain in her elbow, and the numbness in the fingers was also relieved. Radiographs taken after manipulation confirmed the concentric reduction (Figure 2).

OUTCOME AND FOLLOW-UP

At the one-week follow-up, although the patient remained pain-free, the follow-up radiographs revealed a loss of reduction (Figure 3).

Accordingly, a decision was made for open reduction and LCL repair using the Kocher approach. During surgery, the disrupted LCL and joint capsule were exposed just after dissecting the fascia underlying the subcutaneous tissue. The LCL complex was repaired with a suture anchor (DePuy Mitek; Johnson and Johnson, Raynham, MA, United States), and the torn common extensor origin was sutured using non-absorbable sutures (2-0 Ethibond Excel, Ethicon; Johnson and Johnson, Raynham, MA, United States). Elbow joint stability, both in flexion and extension, was evaluated using fluoroscopy. As full ROM of the elbow was achieved, and there was no subluxation or articular incongruity fluoroscopically, the surgery was terminated. No additional intervention was planned for the medial side, and the elbow was immobilized at 90° flexion and neutral rotation in a splint for 5 d.

A hinged elbow brace was subsequently applied to allow active joint movement (12th day after the injury) (Figure 4).

The ROM was controlled by increasing the flexion and extension angles daily after the fifth day of brace application. Full ROM of the elbow was achieved by the end of three weeks post-injury, and the brace was removed.

The patient was followed up for two years, during which she remained symptom free. Figure 5 shows the radiographs at the two-year follow-up; the joint retained concentric reduction with minimal heterotopic ossification along the radiohumeral joint without compromising the ROM for supination and pronation. The patient reported no problems carrying heavy objects or getting up from a chair by pushing bilaterally.

DISCUSSION

Elbow dislocations are more commonly seen in men than in women. They are also more common in the adult age group than in the younger age group. Overall prognosis is better in the younger age group (< 35 years old)[4]. Despite elbow dislocation being a common musculoskeletal injury, SLEDs are rare and seldom managed by closed reduction[1]. Predominantly, only case reports are available for this injury. Even in a systematic review of 342 cases of complete elbow dislocations, only three lateral dislocations were reported[1].

Schnetzke *et al*[15] revealed that in cases of simple elbow dislocations, a diverse range of ligamentous and muscular soft tissue injuries are observed. A subset of patients exhibit prominent injury patterns with a notable emphasis on the medial aspect. These significant findings provide robust evidence for the existence of a valgus mechanism, characterized by the initiation and propagation of a medial force from the medial to anterior regions. Our patient also injured a valgus mechanism.

Ulnar nerve involvement is a common complication with lateral elbow dislocation[10], as reported in our patient; thus, a detailed neurologic examination was necessary at the time of admission. Hopefully, as in our patient, neurological involvement resolves rapidly and spontaneously once nerve compression is relieved by joint reduction. Radiological

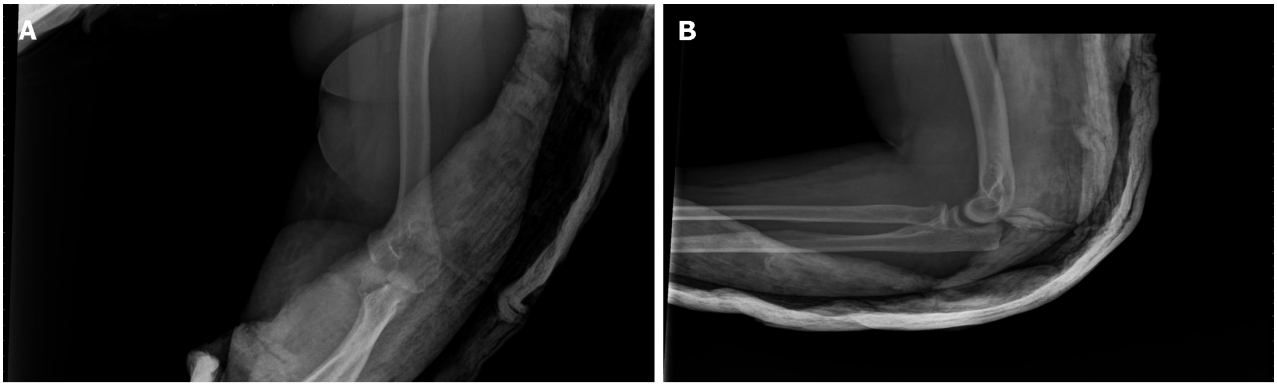

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Figure 2 Roentgenographs after closed reduction. A: Anteroposterior; B: Lateral.

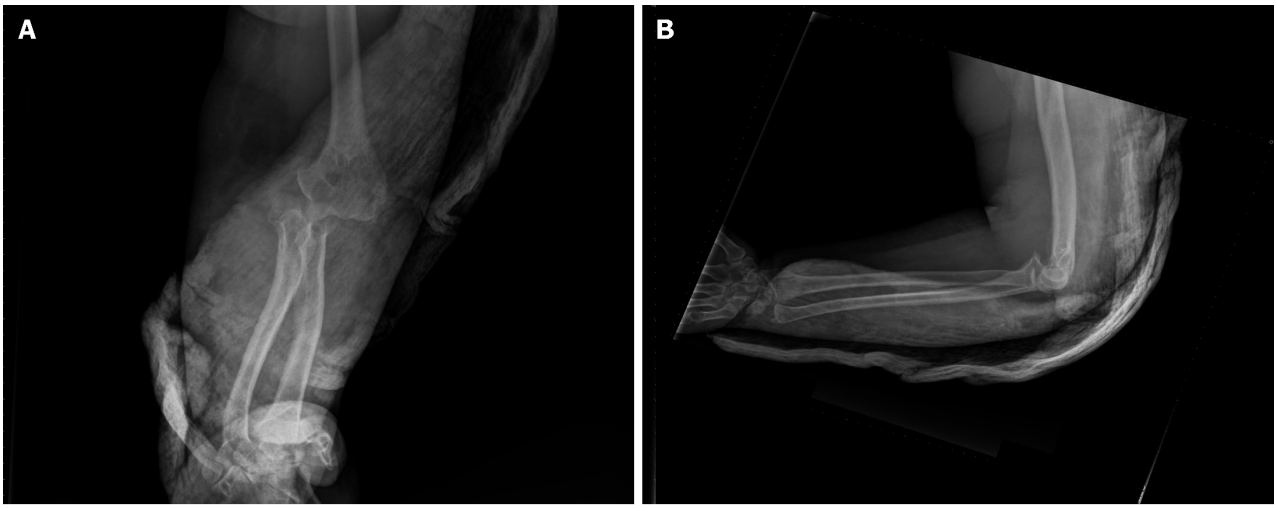

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Figure 3 Roentgenographs after one week. Loss of reduction is seen. A: Anteroposterior; B: Lateral.

investigation is necessary, starting with conventional roentgenography, whereas computed tomography is mandatory if there is an accompanying fracture[5]. In our patient, there was no evidence of a fracture, so we did not perform computed tomography.

There are two treatment options for SLEDs-conservative or surgical. The existing case reports for simple lateral dislocations state that conservative treatment comprising closed reduction and functional treatment with a pressure bandage[1] or splinting[2,7,9-11], followed by early movement, is satisfactory. Moreover, certain closed reduction maneuvers have been specifically designed for lateral elbow dislocations[9-11]. Since our patient also had a simple dislocation, we proceeded with a closed reduction first.

However, a number of studies have described the use of open reduction for lateral elbow dislocations[3-6,8]. Muscle or fracture fragment interposition is often cited as the reason for failure of the closed reduction; however, in our patient, there was no muscle or soft tissue interposing the joint space. We were able to approach the bone just under subcutaneous tissue in the open reduction due to a large defect in the LCL and the joint capsule. Therefore, repair of the lateral complex in elbow dislocation is essential[4]. Micic *et al*[16] and Hobgood *et al*[17] checked elbow joint stability in extension under fluoroscopy after repairing the LCL complex and the common extensor origin, and reported that if the elbow is stable in extension, there is no need to repair medial structures. Similarly, in our patient, the elbow joint was stable in extension after repairing the LCL and common extensor origin, so we decided not to touch the medial side.

According to the publication by de Klerk *et al*[18], surgical intervention may offer a more advantageous result in comparison to non-operative treatment. However, it is not possible to definitively conclude this based solely on the findings of the aforementioned study. It is recommended that future investigations prioritize the comparison between these approaches and additionally determine specific subsets of patients with uncomplicated elbow dislocation who would derive benefits from surgical intervention.

The complications of simple elbow dislocations include loss of motion due to contracture, pain, and heterotopic ossification[4], residual instability is also a major concern[4]. In our case, none of the aforementioned complications were observed with closed reduction; however, when the radiographs revealed a loss of joint congruency at the end of the one-week observation period, open reduction was inevitable.

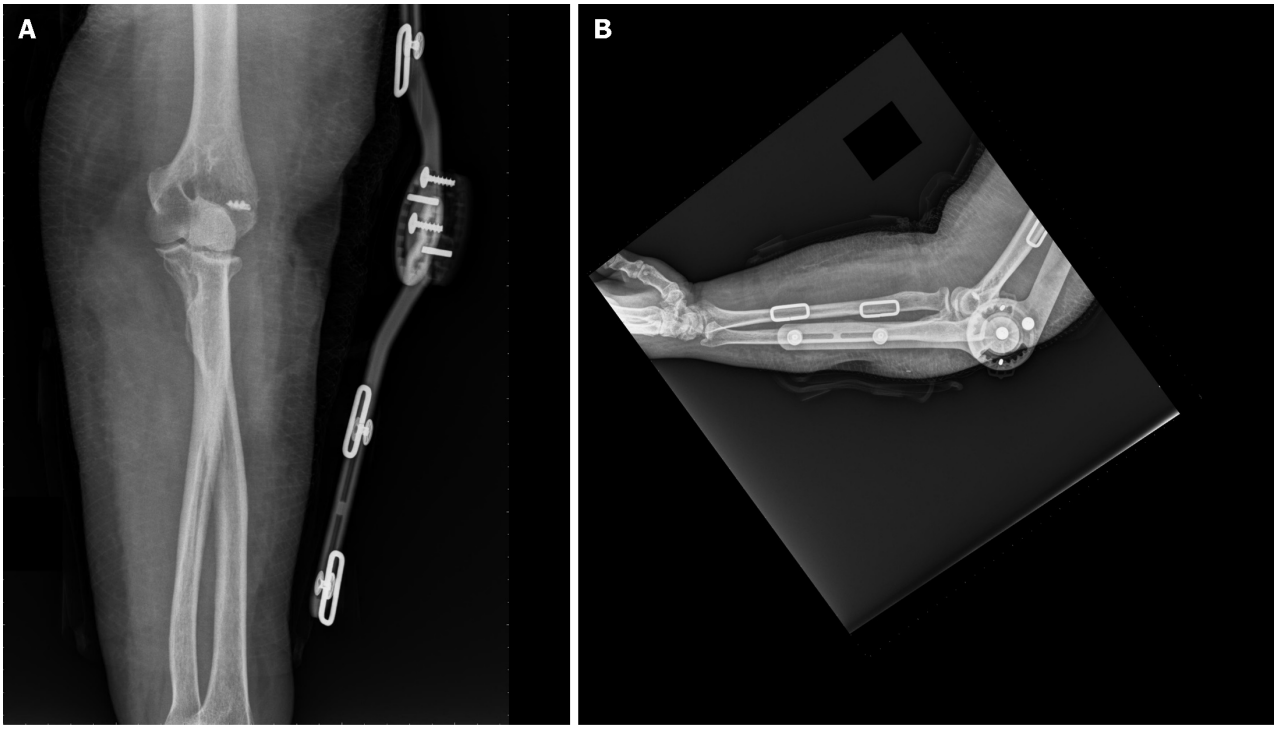

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Figure 4 Roentgenographs after surgery. The elbow is in a brace. A: Anteroposterior; B: Lateral.

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Figure 5 Roentgenographs at the end of two years. A: Anteroposterior; B: Lateral.

If the elbow remains unstable after reduction, primary ligament repair begets sufficient stability to allow early movement, which prevents contractures formation[4]. We also opted for ligament repair along with open reduction, which allowed early ROM exercises, and the patient was protected from developing contractures.

CONCLUSION

Regardless of the severity of the trauma, a closed reduction maneuver while monitoring neurovascular status can efficiently manage SLED. However, in the case of failure of closed reduction, open reduction with additional soft tissue repair may be required to ensure the maintenance of joint congruity. Adequate concentric reduction with conservative or surgical methods allows early resumption of ROM, reduces complications, and provides a more functional joint.

FOOTNOTES

Author contributions: Albayrak M contributed this work, designed the research study, performed the research, contributed new reagents and analytic tools, analyzed the data and wrote the manuscript. The author has read and approved the final manuscript.

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REFERENCES

1 **de Haan J**, Schep NW, Tuinebreijer WE, Patka P, den Hartog D. Simple elbow dislocations: a systematic review of the literature. *Arch Orthop Trauma Surg* 2010; **130**: 241-249 [PMID: 19340433 DOI: 10.1007/s00402-009-0866-0]
2 **Latifi M**, Aziz S, Alaoui A, Essadki B, Fikry T. [Lateral dislocation of the elbow: pathophysiological and therapeutic analysis]. *Rev Chir Orthop Reparatrice Appar Mot* 2003; **89**: 453-456 [PMID: 13679746]
3 **Olasinde AA**, Iryivuze O, Sikakluya FK. Open postero-lateral dislocation of the left elbow secondary to assault: A case report. *Int J Surg Case Rep* 2022; **101**: 107798 [PMID: 36434868 DOI: 10.1016/j.ijscr.2022.107798]
4 **Heo YM**, Yi JW, Lee JB, Lee DH, Park WK, Kim SJ. Unstable Simple Elbow Dislocation Treated with the Repair of Lateral Collateral Ligament Complex. *Clin Orthop Surg* 2015; **7**: 241-247 [PMID: 26217472 DOI: 10.4055/cios.2015.7.2.241]
5 **Ando A**, Hagiwara Y, Koide M, Yamashiro M, Matsuda M, Itoi E. Lateral dislocation of the elbow with concomitant lateral epicondyle fracture: A case report and review of the literature. *J Orthop Sci* 2019; **24**: 563-567 [PMID: 28162856 DOI: 10.1016/j.jos.2016.12.028]
6 **Kim JY**, Choi GJ. Lateral Elbow Dislocation of a Patient with Elbow Flexion Contracture and a Traumatic Brain Lesion. *J Hand Surg Asian Pac Vol* 2021; **26**: 451-454 [PMID: 34380396 DOI: 10.1142/S2424835521720140]
7 **Zaraa M**, Saied W, Bouchoucha S, Ben Ghachem M. [Purely lateral elbow dislocation in a child, case report and literature review]. *Chir Main* 2012; **31**: 38-40 [PMID: 22266353 DOI: 10.1016/j.main.2011.11.007]
8 **Chhaparwal M**, Aroojis A, Divekar M, Kulkarni S, Vaidya SV. Irreducible lateral dislocation of the elbow. *J Postgrad Med* 1997; **43**: 19-20 [PMID: 10740709]
9 **Watanabe K**, Fukuzawa T, Mitsui K. Successful Closed Reduction of a Lateral Elbow Dislocation. *Case Rep Orthop* 2016; **2016**: 5934281 [PMID: 28097029 DOI: 10.1155/2016/5934281]
10 **Khan SK**, Chopra R, Chakravarty D. Successful closed manipulation of a pure lateral traumatic dislocation of the elbow joint using a modified Stimson's technique: a case report. *J Med Case Rep* 2008; **2**: 170 [PMID: 18498622 DOI: 10.1186/1752-1947-2-170]
11 **Gokcen B**, Ozyurek S, Atik A, Sivrioglu AK, Kaya E, Keklikci K. Successful Closed Manipulation of Simple Lateral Dislocation of the Elbow Joint: A Case Report. *Oman Med J* 2013; **28**: e062 [PMID: 31011404 DOI: 10.5001/omj.2013.131]
12 **Pollock JW**, Brownhill J, Ferreira L, McDonald CP, Johnson J, King G. The effect of anteromedial facet fractures of the coronoid and lateral collateral ligament injury on elbow stability and kinematics. *J Bone Joint Surg Am* 2009; **91**: 1448-1458 [PMID: 19487524 DOI: 10.2106/JBJS.H.00222]
13 **Bryce CD**, Armstrong AD. Anatomy and biomechanics of the elbow. *Orthop Clin North Am* 2008; **39**: 141-154 [PMID: 18374805 DOI: 10.1016/j.ocl.2007.12.001]
14 **Safran MR**, Baillargeon D. Soft-tissue stabilizers of the elbow. *J Shoulder Elbow Surg* 2005; **14**: 179S-185S [PMID: 15726079 DOI: 10.1016/j.jse.2004.09.032]

15 **Schnetzke M**, Ellwein A, Maier D, Wagner FC, Grützner PA, Guehring T. Injury patterns following simple elbow dislocation: radiological analysis implies existence of a pure valgus dislocation mechanism. *Arch Orthop Trauma Surg* 2021; **141**: 1649-1657 [PMID: 32780199 DOI: 10.1007/s00402-020-03541-0]

16 **Micic I**, Kim SY, Park IH, Kim PT, Jeon IH. Surgical management of unstable elbow dislocation without intra-articular fracture. *Int Orthop* 2009; **33**: 1141-1147 [PMID: 18677481 DOI: 10.1007/s00264-008-0624-x]

17 **Hobgood ER**, Khan SO, Field LD. Acute dislocations of the adult elbow. *Hand Clin* 2008; **24**: 1-7 [PMID: 18299016 DOI: 10.1016/j.hcl.2007.11.012]

18 **de Klerk HH**, Eygendaal D, van den Bekerom MPJ. We still do not know which patients with a(n) (almost) simple elbow dislocation need an operative treatment. *Eur J Trauma Emerg Surg* 2021; **47**: 875-876 [PMID: 33449128 DOI: 10.1007/s00068-020-01581-0]

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ORIGINAL ARTICLE

Case Control Study

Alternative to mesh repair for ventral hernias: Modified rectus muscle repair

Vijay Naraynsingh, Shamir O Cawich, Samara Hassranah

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Abstract

BACKGROUND

Mesh utilization for ventral hernia repair is associated with potential complications such as mesh infections, adhesions, seromas, fistula formation and significant postoperative pain. The modified rectus muscle repair (RMR) is as an option to repair midline ventral hernias without mesh.

AIM

To evaluate the short term outcomes when the modified RMR was used to repair ventral hernias.

METHODS

This was a 5-year prospective study that examined the outcome of all consecutive patients with ventral abdominal wall hernias > 5 cm in maximal diameter who underwent repair using the modified RMR technique in a single surgeon unit. Patients were reviewed in an outpatient clinic at 3, 6 and 12 mo and evaluated for hernia recurrence on clinical examination. Each patient's abdominal wall was also assessed with using ultrasonography at 24 mo to detect recurrences. All data were examined with SPSS ver 18.0.

RESULTS

Over the 5-year study period, there were 52 patients treated for ventral hernias at this institution. Four patients were excluded and there were 48 in the final study sample, at a mean age of 56 years (range 28-80). The mean maximal diameter of the hernia defect was 7 cm (range 5-12 cm). There were 5 (10.4%) seromas and 1

recurrence (2.1%) at a mean of 36 mo follow-up.

CONCLUSION
The authors recommend the modified RMR as an acceptable alternative to mesh repair of ventral hernias. The seroma rate can be further reduced with routine use of drains. The modified RMR also has the benefit of eliminating all mesh-specific complications.

Key Words: Ventral; Hernia; Mesh; Complication; Recurrence

Core Tip: Mesh utilization for ventral hernia repair is associated with potential complications such as mesh infections, adhesions, seromas, fistula formation and significant postoperative pain. Using the modified Rectus Muscle Repair results in 10.4% seromas, which can be further reduced with routine use of drains. Using the modified Rectus Muscle Repair results in 2.1% recurrences at a mean of 36 mo follow up. The modified Rectus Muscle Repair is as an option to repair midline ventral hernias without mesh.

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INTRODUCTION

In the 21st Century, most surgeons use mesh to repair midline ventral hernias in an attempt to lower recurrence rates[1]. However, mesh utilization is associated with potential complications such as mesh infections, adhesions, seromas, fistula formation and significant postoperative pain[2-7]. These have resulted in numerous lawsuits[8]. Moreover, in low and middle-income countries, both the cost of mesh and its inconstant availability are additional factors that limit its utilization.

The rectus muscle repair (RMR) was described in 1993 as an option to repair midline ventral hernias without mesh[9]. However, we noticed that this technique could not be applied to hernias > 6 cm in maximal diameter, and this prompted our development of a modified RMR, described in detail in a previous report[10].

The short-term recurrence and complication rates of the modified RMR are largely unknown, and this paper will make them clear. We carried out this study to evaluate the short-term outcomes when the modified RMR was used to repair ventral hernias.

MATERIALS AND METHODS

This study was approved by the local institutional review board and performed at a tertiary referral hospital in Trinidad & Tobago, an island state in the Eastern Caribbean. This was a prospective study that spanned a period of 5 years, from January 1, 2015 to December 30, 2019. All consecutive patients who were referred to the surgical department with diagnoses of a ventral abdominal wall hernia were potential candidates for the study. We included all those who were above the age of 18 years, had hernia defects > 5 cm in maximal diameter, and consented to participate. Exclusion criteria included patients who were less than 18 years of age, did not consent to participate, had hernia defects larger than 15 cm in maximal diameter that did not allow primary closure, and those who desired mesh repairs. We collected the following data from all patients who underwent repair using the modified RMR technique in a single surgeon unit: patient demographics, complications, mortality and recurrences. Patients were reviewed in an outpatient clinic at 3, 6 and 12 mo and evaluated for hernia recurrence on clinical examination. Each patient's abdominal wall was also assessed with using ultrasonography at 24 mo to detect recurrences. All data were examined with SPSS ver 18.0.

Technique

The RMR technique has already been described in detail in a previous publication[9]. The technique focused on bringing the recti together in the midline by full thickness nylon sutures through the anterior sheath, rectus muscle and posterior sheath on one side and continued through the posterior sheath, muscle and anterior sheath of the opposite side (Figure 1A). Thus, when brought together, the hernia sac and attenuated linea alba are inverted ventrally towards the peritoneal cavity (Figure 1B); the sac is not opened unless multiloculated. The inversion resembles the Keel operation but the major difference is that the suture must engage more than 1cm of rectus muscle and its sheaths whereas the Keel engages the 'fibroaponeurotic' tissue around the hernia.

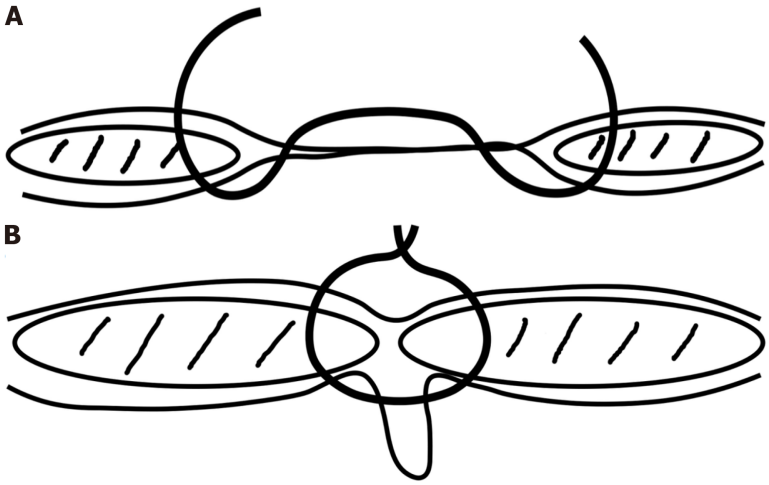

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Figure 1 Rectus muscle repair technique. A: The suture engages full thickness of rectus abdominis muscle and its anterior and posterior sheaths; B: When pulled together, the recti assume a midline position, inverting the attenuated linea alba and hernia sac.

The suture bites engage 1.5-2 cm of rectus sheath and muscle on each side and successive bites are 1.5cm apart. The anterior sheath is dissected to expose 3-4 cm lateral to the medial margin of the rectus muscle; this allows enough space for suturing the muscle as well as incising the anterior sheath, not the muscle (Figure 2). In this center, we used the modified RMR technique previously described[10], where relaxing incisions were made in the anterior rectus sheath (Figure 3) in an attempt to reduce tension on the suture line. The anterior sheath relaxing incision did not extend > 1 cm below the umbilicus because the posterior rectus sheath was deficient below this point. This differs from the Ramirez procedure in that (1) the dissection is not carried far laterally to the lateral border of the rectus muscle; and (2) the relaxing incision is in the anterior rectus sheath, not the external oblique aponeurosis. Haemostasis was achieved and a subcuticular suture was placed to close skin. For large defects, a subcutaneous drain was used. This was strictly an observational study and the attending surgeon was solely responsible for clinical decisions.

RESULTS

Over the 5-year study period, there were 52 patients treated for ventral hernias at this institution. Four patients were excluded due to a desire to have mesh repair (2) and large hernias defects (15 cm and 17 cm) that did not allow primary suture closure (2). The final study sample, therefore, was 48 patients with ventral hernias. These included umbilical hernias (15), para-umbilical hernias (12), supra-umbilical (9) and incisional (12).

There were 48 patients in the final study sample, at a mean age of 56 years (range 28-80). Of this 46 patients had elective repairs and 2 patients with paraumbilical hernias had emergency repairs after presenting with strangulation. The mean maximal diameter of the hernia defect was 7 cm (range 5-12 cm); see distribution in Table 1.

Abdominal drains were used in 30 patients. Eighteen patients had no drains placed, at the decision of the attending surgeon, and 5 of these patients developed clinically significant seromas, requiring aspiration between post-operative days 7-14. There were no seromas in the sub-group in which drains were used. There were no haematomas detected and no other complications were recorded in any patients.

The mean follow up time was 36 mo (range 12-60 mo). There was 1 (2.1%) recurrence diagnosed on clinical examination at the eight post-operative month in a patient who underwent incisional hernia repair. On reoperation, the nylon suture line was intact; the defect had recurred lateral to it, near the umbilicus. The suture had not engaged the muscle and its two sheaths - an error in technique.

DISCUSSION

Hernia repairs were initially done using sutures to close the defect primarily, but the problem of recurrence eluded surgeons. Theodore Billroth[11] in 1890 first postulated that a prosthesis could be used to close the defect but, at that time, mesh repair was met with high complication rates[11,12]. At that time the quality of material used, the absence of haemostatic devices and paucity of antibiotics would have contributed to the high complication rate. In 1958, Francis Usher published his research on the more inert polypropylene mesh and it was adopted as the gold standard of hernia repair compared to primary suture repair[12,13]. Mesh has become so widely accepted that Pawlak *et al*[1] reported that it was used in 75% of all hernias repaired in the United Kingdom in the year 2020.

While we agree that the use of mesh in ventral hernia repair generally reduces the rate of recurrence when compared to non-mesh repair [14], we also note that many of the existing non-mesh techniques focus on accurately placing non-

Table 1 Type, size and number of hernias

Hernia type	No.	Mean diameter
Umbilical	15	6 cm
Paraumbilical	12	7 cm
Supraumbilical	9	9 cm
Incisional	12	8 cm

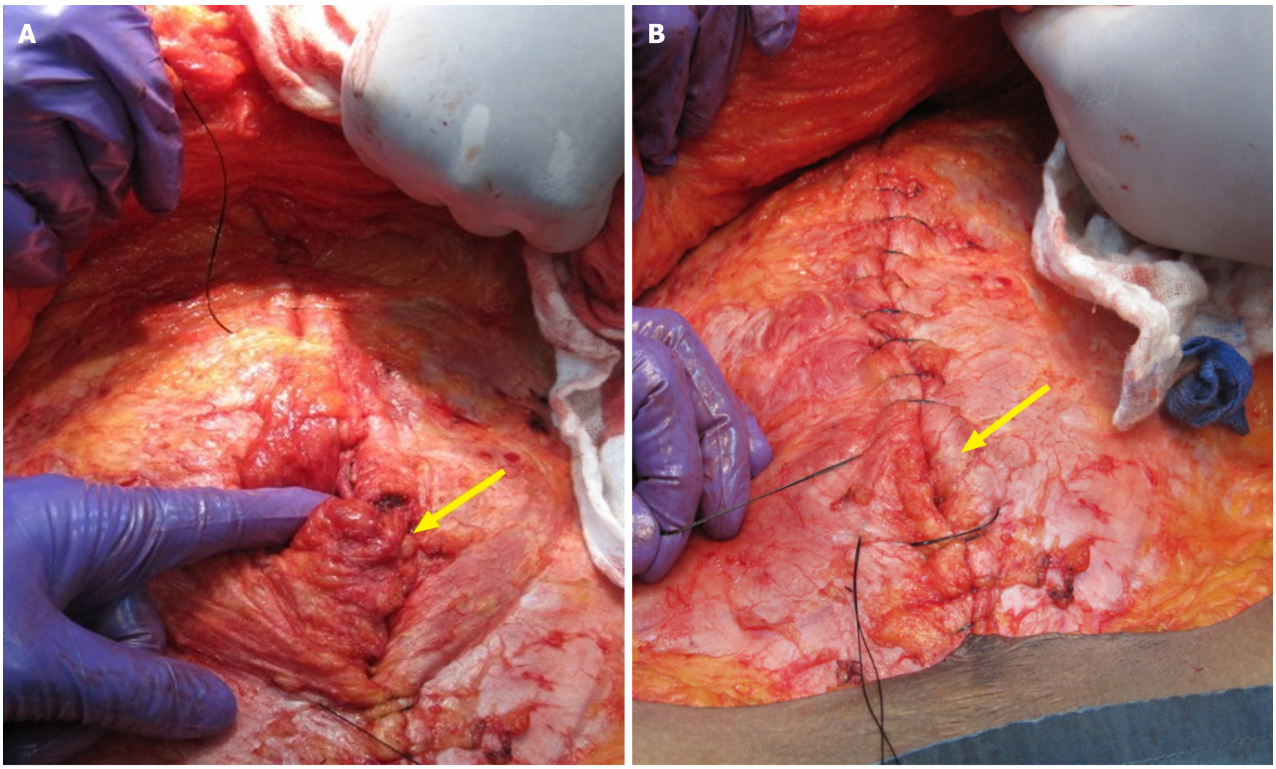

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Figure 2 The hernia sac and attenuated linea alba are inverted by placing full-thickness sutures to approximate the rectus abdominis muscles (arrows). A: The sutures incorporate the anterior and posterior sheaths en masse including the medial 1-1.5 cm of the muscle; B: All attenuated midline tissues are therefore eliminated (by inverting them).

absorbable sutures in the linea alba 1cm from the midline[15]. In our opinion, this is not ideal because the linea alba in patients with hernias is often already attenuated and quite wide. We agree with Naraynsingh *et al*[16] who wrote "it seems logical that a repair which eliminates the linea alba should minimise the risk of recurrence."

The Rives-Stoppa repair is the main technique when mesh is utilized, but it is a challenging operation[17] and may not always be accurately reproduced. Additionally, there are two issues that deserve further consideration before mesh is used for ventral hernia repair: Mesh complications and mechanism of recurrence.

Mesh complications

Mesh infection remains a concern despite aseptic technique and perioperative antibiotic prophylaxis[4,5,18,19]. Peri-operative antibiotics reduce, but do not eliminate, mesh infections. Ríos *et al*[18] reported that mesh infections reduced from 26.3% to 13.6% when peri-operative antibiotics were administered to patients who underwent mesh repairs of incisional hernias. Apart from the fact that many patients who develop hernias already harbour conditions that predispose to infections, such as obesity, increased age, diabetes and/or a history of smoking[4,20,21], the mere presence of a foreign body reduces the number of bacteria needed to cause an infection by 100000[22,23].

Adhesion formation with bowel involvement can lead to obstruction[24] and abdominal pain[25] in these patients. Aubé *et al*[26] reported that significant adhesions form after 14% of mesh hernia repairs.

The mesh can also lead to irritation and post-operative pain. Chronic post-operative pain, persisting for > 3 mo, occurs in 11%[7] to 17%[27] of patients after ventral hernia repairs. This results in poor function and reduced quality of life in 10%[28] to 26%[28] of patients after undergoing mesh hernia repair, and up to 13% of patients need occasional analgesics up to 4 years after the procedure[28].

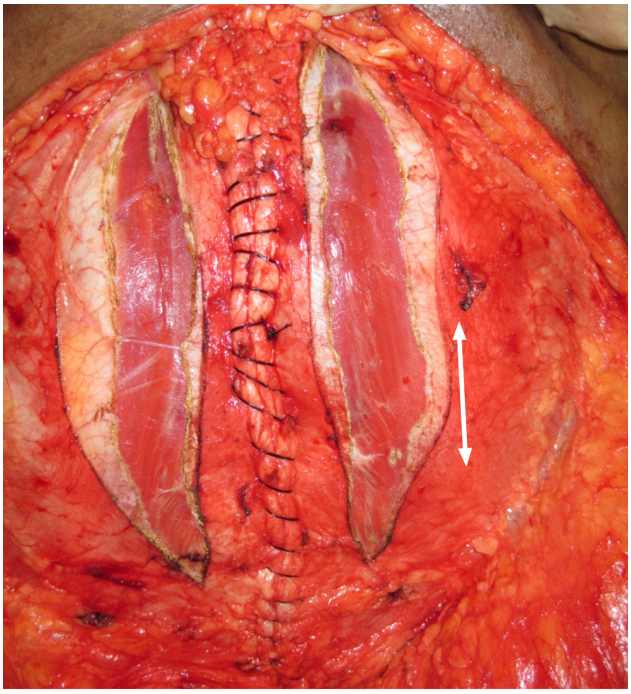

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Figure 3 Relaxing incisions are made in the anterior rectus sheath in order to reduce tension on the suture line.

The incidence of seromas was reported by Bauer *et al*[29] to be 5% with polytetrafluoroethylene mesh and Molloy *et al*[30] reported 4% incidence of seromas and 2% incidence of haematomas with Marlex® mesh. In our study, we did not encounter any haematomas. The incidence of seromas was greater than expected (10.4%), although we noted that these occurred only when drains were omitted. A reasonable further modification could be the routine use of drains as there is no risk of prosthesis infections.

Fistula formation is a relatively rare complication of mesh use, but when it occurs it is a devastating complication[5,6].

In addition to these known complications, the cost of the mesh and the price of treating these complications are yet to be addressed and quantified[2-7]. Given the number of complications associated with mesh repairs, a dedicated legal industry dedicated has developed. In 2011, C.R. Bard was made to pay USD$184 million to settle approximately 3000 cases of mesh failure[8]. This was the largest case of this type but in November 2019, there were over 7000 similar lawsuits pending against Ethicon, Atrium and Bard[31]. There is no established method to quantify the burden of stress to the patients and surgeons dealing with these legalities, but we firmly believe that the money and time spent to settle these lawsuits should be taken into account before a decision is made to use mesh in ventral hernia repairs.

We also suggest that this decision should also include the cost of care to treat mesh complications. Plymale *et al*[32] identified 34 patients who had ventral hernia repair and subsequent mesh removal. The median cost was approximately double for the removal than for the ventral hernia repair, and the majority of patients developed recurrences.

Mechanisms of hernia recurrence

Midline ventral hernias recur through the linea alba, almost never through the rectus muscles with their anterior and posterior sheaths. It seems logical that the modified RMR which eliminates the linea alba should minimise the risk of recurrence. This study documented that there was a 2.1% recurrence rate after the modified RMR. Additionally, we consider the single recurrence in this series to be due to a technical failure since the recurrence occurred at an area where the sutures did not engage the anterior sheath, rectus muscle and posterior sheath en masse.

Mesh repairs, on the other hand, do not focus on elimination of the defective linea alba. It was not surprising, therefore, that the surgical literature reported greater recurrence rates after mesh repairs, ranging from 2.7%-20%[3,4,7,33,34]. In our opinion this was predictable, considering that recurrence following mesh repair does not occur through the rectus abdominis muscle nor through the mesh itself. Recurrences occur through the linea alba, above, below or beside the mesh.

Modified RMR repair

Although the European Hernia Society and American Hernia Society recommend use of mesh in the umbilical and epigastric hernias more than 1 cm in size[35], many authors have demonstrated the feasibility of successful non-mesh repair in much larger hernias. Ramirez showed that component separation may allow closure of large defects (up to 35 cm) without using prostheses[36]. Using this technique as a modification, Girotto *et al*[37] were able to achieve a recurrence rate of 6% in 30 patients and Shestak *et al*[38] reported 5% recurrence rate in 22 patients with 6-14 cm defects after 52 mo follow up. Thus, in spite of the general recommendations, it is possible to achieve acceptable results without using mesh, but none of these emphasize muscular approximation with elimination of the linea alba as we are

advocating.

This study has demonstrated that the modified RMR technique carries a lower morbidity risk than the surgical literature reports for mesh ventral hernia repairs[4,7,19,24,27] and avoids the financial and medico-legal ramifications associated with mesh complications[8,31]. With a low morbidity profile and 2.1% recurrence after 36 mo mean follow-up, we suggest that the modified RMR technique should be seriously considered as a viable option for ventral hernia repair.

CONCLUSION

The modified RMR is an acceptable alternative to mesh repair of ventral hernias. The technique carries a 10.4% seroma rate, but this can be further reduced with routine use of drains. The modified RMR also has the benefit of eliminating all mesh-specific complications.

ARTICLE HIGHLIGHTS

Research background

This study examined the use of a novel procedure to repair ventral hernias without the use of prosthetic mesh. This is a newly described technique.

Research motivation

Mesh utilization for ventral hernia repair may potentially lead to mesh infections, adhesions, seromas, fistula formation and postoperative pain. If the modified Rectus Muscle Repair technique is shown to be effective and safe, then it may lead to the omission of mesh in patients with ventral hernias.

Research objectives

The objective of this study was to examine the short term outcomes of all consecutive patients with ventral abdominal wall hernias > 5 cm in maximal diameter who underwent repair using the modified rectus muscle repair (RMR) technique in a single surgeon unit.

Research methods

A 5-year prospective study was undertaken to examine the outcome of all consecutive hernia repairs using the modified RMR technique. Patients were reviewed in an outpatient clinic at 3, 6 and 12 mo and evaluated for hernia recurrence on clinical examination. Each patient's abdominal wall was also assessed with using ultrasonography at 24 mo to detect recurrences. All data were examined with SPSS ver 18.0.

Research results

There were 52 patients treated for ventral hernias, and 4 were excluded, leaving 48 in the final study sample, at a mean age of 56 years (range 28-80). The mean maximal diameter of the hernia defect was 7 cm (range 5-12 cm). There were 5 (10.4%) seromas and 1 recurrence (2.1%) at a mean of 36 mo follow-up.

Research conclusions

This study proposes that the modified RMR can be used as an acceptable alternative to mesh repair of ventral hernias. The new method that this study suggests is the routine use of drains to reduce seroma rates

Research perspectives

Further study of larger case series is warranted since this early research shows encouraging results.

FOOTNOTES

Author contributions: Naraynsingh V conceptualized the manuscript and checked scientific integrity; Cawich SO wrote the manuscript and checked for scientific integrity; Hassranah S prepared images, collected data and checked the manuscript for scientific integrity

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Informed consent statement: This is to confirm that I give consent to the use of my operation data for publication purposes. Both the pictures of the surgery as well as the clinical findings may be used on the understanding that these will be anonymous and I will not be personally identifiable. Neither my name nor face will be shown.

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Data sharing statement: All data are stored by the corresponding author and will be released upon reasonable request

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REFERENCES

1 **Pawlak M**, Tulloh B, de Beaux A. Current trends in hernia surgery in NHS England. *Ann R Coll Surg Engl* 2020; **102**: 25-27 [PMID: 31418302 DOI: 10.1308/rcsann.2019.0118]
2 **Narkhede R**, Shah NM, Dalal PR, Mangukia C, Dholaria S. Postoperative Mesh Infection-Still a Concern in Laparoscopic Era. *Indian J Surg* 2015; **77**: 322-326 [PMID: 26702240 DOI: 10.1007/s12262-015-1304-x]
3 **Luijendijk RW**, Hop WC, van den Tol MP, de Lange DC, Braaksma MM, IJzermans JN, Boelhouwer RU, de Vries BC, Salu MK, Wereldsma JC, Bruijninckx CM, Jeekel J. A comparison of suture repair with mesh repair for incisional hernia. *N Engl J Med* 2000; **343**: 392-398 [PMID: 10933738 DOI: 10.1056/NEJM200008103430603]
4 **Nguyen MT**, Berger RL, Hicks SC, Davila JA, Li LT, Kao LS, Liang MK. Comparison of outcomes of synthetic mesh vs suture repair of elective primary ventral herniorrhaphy: a systematic review and meta-analysis. *JAMA Surg* 2014; **149**: 415-421 [PMID: 24554114 DOI: 10.1001/jamasurg.2013.5014]
5 **Bostanci O**, Idiz UO, Yazar M, Mihmanli M. A Rare Complication of Composite Dual Mesh: Migration and Enterocutaneous Fistula Formation. *Case Rep Surg* 2015; **2015**: 293659 [PMID: 26550515 DOI: 10.1155/2015/293659]
6 **Rezende-Neto J**, Marshall S, Nixon K, Vlachou P, Rotstein O. Chronic Infection and Enterocutaneous Fistula Secondary to Mesh Migration and Erosion into the Small Bowel. *Surgical Infections Case Reports* 2017; **2**: 17-19 [DOI: 10.1089/crsi.2017.0003]
7 **McLanahan D**, King LT, Weems C, Novotney M, Gibson K. Retrorectus prosthetic mesh repair of midline abdominal hernia. *Am J Surg* 1997; **173**: 445-449 [PMID: 9168086 DOI: 10.1016/S0002-9610(97)89582-7]
8 **Drugwatch**. Hernia Mesh Lawsuits | Mesh Lawsuit |Settlement Amounts & Top Lawyers. Available from: http://www.drugwatch.com/hernia-mesh/Lawsuits
9 **Naraynsingh V**, Ariyanayagam D. Rectus repair for midline ventral abdominal wall hernia. *Br J Surg* 1993; **80**: 614-615 [PMID: 8518903 DOI: 10.1002/bjs.1800800523]
10 **Naraynsingh V**, Hassranah S, Maharaj S, Singh Y, Harnanan D, Islam S, Cawich SO. A Modification of the Rectus Muscle Repair for Repair Ventral Hernias: Case Report. *Med Res Arch* 2023; **11**: 1-4 [DOI: 10.18103/mra.v11i9.4515]
11 **Billroth T**. The Medical Sciences in the German Universities: A Study in the History of Civilization. New York, NY, USA: Welch, W. H., Ed.; Macmillan; 1924
12 **Baylón K**, Rodríguez-Camarillo P, Elías-Zúñiga A, Díaz-Elizondo JA, Gilkerson R, Lozano K. Past, Present and Future of Surgical Meshes: A Review. *Membranes (Basel)* 2017; **7** [PMID: 28829367 DOI: 10.3390/membranes7030047]
13 **Elango S**, Perumalsamy S, Ramachandran K, Vadodaria K. Mesh materials and hernia repair. *Biomedicine (Taipei)* 2017; **7**: 16 [PMID: 28840830 DOI: 10.1051/bmdcn/2017070316]
14 **Peralta R**, Latifi R. Long-term outcomes of abdominal wall reconstruction. what are the real numbers? *World J Surg* 2012; **36**: 534-538 [PMID: 22311141 DOI: 10.1007/s00268-012-1454-y]
15 **Dudley H**. Access to the abdomen and lower chest. 2nd ed. London: Butterworths; 1986
16 **Naraynsingh V**, Maharaj R, Dan D, Hariharan S. Strong linea alba: myth or reality? *Med Hypotheses* 2012; **78**: 291-292 [PMID: 22137498 DOI: 10.1016/j.mehy.2011.11.004]
17 **Heartsill L**, Richards ML, Arfai N, Lee A, Bingener-Casey J, Schwesinger WH, Sirinek KR. Open Rives-Stoppa ventral hernia repair made simple and successful but not for everyone. *Hernia* 2005; **9**: 162-166 [PMID: 15723151 DOI: 10.1007/s10029-005-0319-9]
18 **Ríos A**, Rodríguez JM, Munitiz V, Alcaraz P, Pérez Flores D, Parrilla P. Antibiotic prophylaxis in incisional hernia repair using a prosthesis. *Hernia* 2001; **5**: 148-152 [PMID: 11759801 DOI: 10.1007/s100290100026]
19 **den Hartog D**, Dur AH, Tuinebreijer WE, Kreis RW. Open surgical procedures for incisional hernias. *Cochrane Database Syst Rev* 2008; **2008**: CD006438 [PMID: 18646155 DOI: 10.1002/14651858.CD006438.pub2]
20 **Mavros MN**, Athanasiou S, Alexiou VG, Mitsikostas PK, Peppas G, Falagas ME. Risk factors for mesh-related infections after hernia repair surgery: a meta-analysis of cohort studies. *World J Surg* 2011; **35**: 2389-2398 [PMID: 21913136 DOI: 10.1007/s00268-011-1266-5]
21 **Kao AM**, Arnold MR, Augenstein VA, Heniford BT. Prevention and Treatment Strategies for Mesh Infection in Abdominal Wall Reconstruction. *Plast Reconstr Surg* 2018; **142**: 149S-155S [PMID: 30138283 DOI: 10.1097/PRS.0000000000004871]
22 **Klinge U**, Junge K, Spellerberg B, Piroth C, Klosterhalfen B, Schumpelick V. Do multifilament alloplastic meshes increase the infection rate? Analysis of the polymeric surface, the bacteria adherence, and the in vivo consequences in a rat model. *J Biomed Mater Res* 2002; **63**: 765-771 [PMID: 12418022 DOI: 10.1002/jbm.10449]
23 **An YH**, Friedman RJ. Concise review of mechanisms of bacterial adhesion to biomaterial surfaces. *J Biomed Mater Res* 1998; **43**: 338-348

[DOI: 10.1002/(SICI)1097-4636(199823)43:3<338::AID-JBM16>3.0.CO;2-B]

24 **Zinther NB**, Fedder J, Friis-Andersen H. Noninvasive detection and mapping of intraabdominal adhesions: a review of the current literature. *Surg Endosc* 2010; **24**: 2681-2686 [PMID: 20512510 DOI: 10.1007/s00464-010-1119-6]

25 **Mussack T**, Fischer T, Ladurner R, Gangkofer A, Bensler S, Hallfeldt KK, Reiser M, Lienemann A. Cine magnetic resonance imaging vs high-resolution ultrasonography for detection of adhesions after laparoscopic and open incisional hernia repair: a matched pair pilot analysis. *Surg Endosc* 2005; **19**: 1538-1543 [PMID: 16247569 DOI: 10.1007/s00464-005-0092-y]

26 **Aubé C**, Pessaux P, Tuech JJ, du Plessis R, Becker P, Caron C, Arnaud JP. Detection of peritoneal adhesions using ultrasound examination for the evaluation of an innovative intraperitoneal mesh. *Surg Endosc* 2004; **18**: 131-135 [PMID: 14625740 DOI: 10.1007/s00464-003-9056-2]

27 **Liang MK**, Clapp M, Li LT, Berger RL, Hicks SC, Awad S. Patient Satisfaction, chronic pain, and functional status following laparoscopic ventral hernia repair. *World J Surg* 2013; **37**: 530-537 [PMID: 23212794 DOI: 10.1007/s00268-012-1873-9]

28 **Paajanen H**, Hermunen H. Long-term pain and recurrence after repair of ventral incisional hernias by open mesh: clinical and MRI study. *Langenbecks Arch Surg* 2004; **389**: 366-370 [PMID: 15605167 DOI: 10.1007/s00423-003-0440-0]

29 **Bauer JJ**, Harris MT, Kreel I, Gelernt IM. Twelve-year experience with expanded polytetrafluoroethylene in the repair of abdominal wall defects. *Mt Sinai J Med* 1999; **66**: 20-25 [PMID: 9989101]

30 **Molloy RG**, Moran KT, Waldron RP, Brady MP, Kirwan WO. Massive incisional hernia: abdominal wall replacement with Marlex mesh. *Br J Surg* 1991; **78**: 242-244 [PMID: 2015485 DOI: 10.1002/bjs.1800780237]

31 **Drugwatch**. Available from: https://www.drugwatch.com/news/2020/10/26/status-of-bard-ethicon-atrium-hernia-mesh-lawsuits/#sources

32 **Plymale MA**, Davenport DL, Walsh-Blackmore S, Hess J, Griffiths WS, Plymale MC, Totten CF, Roth JS. Costs and Complications Associated with Infected Mesh for Ventral Hernia Repair. *Surg Infect (Larchmt)* 2020; **21**: 344-349 [PMID: 31816266 DOI: 10.1089/sur.2019.183]

33 **Piccoli M**, Pecchini F, Vetrone G, Linguerri R, Sarro G, Rivolta U, Elio A, Piccirillo G, Faillace G, Masci E, Guglielminetti D, Santorelli C, Soliani G, Koleva Radica M, Trapani V, Marchi D, Chester J, Leonardi L, Neri S. Predictive factors of recurrence for laparoscopic repair of primary and incisional ventral hernias with single mesh from a multicenter study. *Sci Rep* 2022; **12**: 4215 [PMID: 35273288 DOI: 10.1038/s41598-022-08024-3]

34 **Kadakia N**, Mudgway R, Vo J, Vong V, Seto T, Bortz P, Depew A. Long-Term Outcomes of Ventral Hernia Repair: An 11-Year Follow-Up. *Cureus* 2020; **12**: e9523 [DOI: 10.7759/cureus.9523]

35 **Henriksen NA**, Montgomery A, Kaufmann R, Berrevoet F, East B, Fischer J, Hope W, Klassen D, Lorenz R, Renard Y, Garcia Urena MA, Simons MP; European and Americas Hernia Societies (EHS and AHS). Guidelines for treatment of umbilical and epigastric hernias from the European Hernia Society and Americas Hernia Society. *Br J Surg* 2020; **107**: 171-190 [PMID: 31916607 DOI: 10.1002/bjs.11489]

36 **Ramirez OM**, Ruas E, Dellon AL. "Components separation" method for closure of abdominal-wall defects: an anatomic and clinical study. *Plast Reconstr Surg* 1990; **86**: 519-526 [PMID: 2143588 DOI: 10.1097/00006534-199009000-00023]

37 **Girotto JA**, Ko MJ, Redett R, Muehlberger T, Talamini M, Chang B. Closure of chronic abdominal wall defects: a long-term evaluation of the components separation method. *Ann Plast Surg* 1999; **42**: 385-94; discussion 394 [PMID: 10213399 DOI: 10.1097/00000637-199904000-00007]

38 **Shestak KC**, Edington HJ, Johnson RR. The separation of anatomic components technique for the reconstruction of massive midline abdominal wall defects: anatomy, surgical technique, applications, and limitations revisited. *Plast Reconstr Surg* 2000; **105**: 731-8; quiz 739 [PMID: 10697187]

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CASE REPORT

Endoscopic intermuscular dissection for locally advanced rectal cancer: A case report

Anurag Sekra, Tracy Tan

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Abstract

BACKGROUND

Endoscopic submucosal dissection is considered curative for patients with early rectal cancer when level of submucosal invasion is < 1000 microns with favourable histopathological features. Recent data suggests even deeper submucosal invasion can potentially be curative if R0 resection can be achieved and when no high-risk histopathological features are seen in the resected specimen. To achieve R0 resection, deeper dissection is required.

CASE SUMMARY

A 66 year old New Zealand European male presented with 3 mo history of per rectal bleeding. He was referred for a colonoscopy test to investigate this further. This revealed a malignant appearing lesion in the rectum. Biopsies however showed high grade dysplasia only. Given endoscopic appearances suspicious for deep submucosal invasion, patient was consented for endoscopic intermuscular dissection (EID). The case was successfully performed, and the presence of muscularis propria was confirmed in the resected specimen. There were no complications and total procedure time was 124 min. Lesion was clear of radial margins however deep margins were positive confirming it was at least a pT2 cancer. Patient was recommended to have further treatment but could not have radical surgery due to comorbidities and instead was referred for long course chemoradiotherapy.

CONCLUSION

EID is a safe and feasible option for management of rectal cancer in highly selected patients.

Key Words: Endoscopic intermuscular dissection; Endoscopic submucosal dissection;

Rectal cancer; Interventional endoscopy; Case report

Core Tip: Endoscopic intermuscular dissection is a novel technique for management of locally advanced rectal cancer especially for patients who are not fit for oncological surgery or chemoradiotherapy. This technique ensures local resection of the tumour which is safe and feasible with minimal recovery times.

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INTRODUCTION

Endoscopic submucosal dissection (ESD), for early rectal cancer, is considered a curative option for patients. It is an organ preserving surgery with higher rates of en bloc resection and lower risk of local recurrence compared with endoscopic mucosal resection[1]. It is significantly cheaper than radical surgery, with significantly fewer days in hospital and has lower morbidity and mortality[2-4].

Early rectal cancer is defined as T1 cancer with invasion < 1000 microns into the submucosa (SM) or SM1 Kikuchi levels, as the risk of nodal metastasis is close to 0%. ESD is considered curative for these lesions[5].

Recent European Society of Gastrointestinal Endoscopy guidelines also recommend that an en bloc R0 resection of a superficial lesion with histology no more advanced than well-differentiated adenocarcinoma (G1/G2), sm1 (< 1 mm SM invasion) with no lymphovascular invasion (LVI), would be considered curative. Surgery, on the other hand, is recommended when LVI (deeper infiltration than SM1), positive/ non evaluable vertical margins, or poorly differentiated tumour with SM invasion is diagnosed[6]. However, more recent data suggests that the depth of SM invasion is not an independent risk factor for lymph node metastasis (LNM) in T1 colorectal cancer (CRC)[7]. Several studies have shown that in the absence of adverse histopathological risk factors, such as; poor differentiation, high tumour budding, LVI, and perineural invasion, the risk of LNM (regardless of depth of SM invasion) is extremely low[8-11].

With ESD the dissection plane is limited to SM. As a result, the vertical margins are more likely to be positive if the lesions invade deeper into the SM[12]. More recently, endoscopic intermuscular dissection (EID) technique has been described to achieve R0 resection for the management of lesions with deeper submucosal invasion[13,14].

EID technique has evolved from ESD. The principle of ESD is based on the dissection of the submucosal plane. EID, on the other hand, focuses on the dissection of the superficial circular muscle layer of the rectum, allowing the longitudinal layer to remain intact. This essentially means that the EID can achieve a deeper dissection compared to ESD.

CASE PRESENTATION

Chief complaints

A 66 year old New Zealand European male presented with per rectal bleeding.

History of present illness

Patient presented with 3 mo history of intermittent per rectal bleeding. He reported that the blood was often mixed in the stools. He did not report any history of of changes in bowel habits or weight loss.

History of past illness

Patient has known history of ischaemic heart disease and he underwent a previous angioplasty. He has known congestive heart failure from ischaemic cardiomyopathy. He also had poorly controlled type 2 diabetes mellitus and is on insulin.

Personal and family history

There was no known personal or family history of bowel cancer.

Physical examination

A physical exam including a digital rectal exam was completely normal.

Laboratory examinations

Patient's full blood count, iron studies, and carcinoembryonic antigen were all normal.

Imaging examinations

The colonoscopy revealed a 30 mm rectal tumour, located 10 cm from anal verge, at the posterior wall of the rectum. The lesion was IIc/IIa lesion as per Paris classification (Figure 1A). There was a type Vn Kudo pit pattern in the area of the depression. Magnification virtual chromoendoscopy revealed a Narrow Band Imaging International Colorectal Endoscopic classification 3, Japan Narrow Band Imaging Expert Team classification 3 lesion (Figure 1B). Biopsies taken from the lesion showed high grade dysplasia only. The patient underwent a staging computed tomography scan which did not shown any evidence of metastatic disease. Magnetic resonance imaging showed a T2N0M0 rectal lesion at the posterior wall.

An invasive cancer was suspected based on the endoscopic features. Consequently, the patient was referred to the colorectal surgeons for further management. Since initial biopsies had shown high grade dysplasia only, the patient underwent a second biopsy, which again showed high grade dysplasia. Due to the clinical suspicion of invasive cancer, the patient was then considered for radical surgery. Unfortunately, he had significant comorbidities and was therefore deemed an unsuitable candidate for radical surgery. He was further evaluated for a transanal minimally invasive surgery for accurate staging and diagnosis, but was deemed extremely high risk to even receive a general anaesthesia.

MULTIDISCIPLINARY EXPERT CONSULTATION

The case was discussed in the multidisciplinary team meeting and the consensus was to perform an endoscopic resection with a view to; confirm the diagnosis, accurately stage the disease, and to attempt a curative resection. Because a deep invasion was suspected, the patient was consented for an EID under conscious sedation.

FINAL DIAGNOSIS

Invasive rectal cancer.

TREATMENT

Patient underwent EID procedure. The procedure was performed under conscious sedation with midazolam and fentanyl. A standard gastroscope (Olympus GIF-HQ190, Olympus, Tokyo, Japan) with a transparent hood (Olympus, Tokyo, Japan) was used. Submucosal lifting was performed with a mixture of adrenaline, methylene blue, and hydroethyl starch (Voluven® 6%). A 1.5 mm dual knife J (Olympus, America) was used, with an endocut mode of the ERBE VIO 300D (ERBE Elektromedizin, Tübingen, Germany).

Firstly, a mucosal incision was created at the anal side of the lesion. Submucosal dissection was then performed in the same area. This was, however, stopped due to poor access and visualisation of the submucosal space. An incision was then made at the oral side and the circumferential incision was completed. The scope was entered into the submucosal space using the transparent hood. Significant fibrosis was encountered at this point. The fibrotic area was dissected (Figure 2A). The inner circular layer was visible at this point. An attempt was made to inject just above the muscle layer; however, this could not be achieved due to fibrosis. The inner circular layer was then dissected from the oral side to the anal side of the lesion, managing to keep the outer longitudinal layer intact (Figure 2B). The tumour was finally released from the muscle layer and was resected en bloc. The lesion was pinned on the cork and then submitted for histology (Figure 2C). The total procedure time was 124 min. The patient was given IV antibiotics intraoperatively and was discharged home after 2 h of observation. He received a one-week course of oral antibiotics. There were no immediate or delayed complications noted.

Figure 2A shows the significance of the fibrosis encountered during Endoscopic Intermuscular Dissection. After dissecting the fibrotic area, the inner muscle layer was dissected, keeping the outer longitudinal layer intact, as shown in Figure 2B. The tumour was released from the muscle layer and pinned on the cork board and submitted for histological analysis (Figure 2C).

The histology confirmed the presence of muscularis propria in the specimen. This is a low-grade adenocarcinoma, with absent LVI, absent perineural invasion and low tumour budding. The lesion was clear of peripheral margins by 7 mm. Vertical margins, however, confirmed infiltration of the tumour into the muscularis propria and were positive. This confirmed it as at least a pT2 lesion (Figure 3).

OUTCOME AND FOLLOW-UP

This histology was again discussed in a multidisciplinary meeting, and it was concluded that the patient will require additional treatment. He was referred for long course chemoradiotherapy, which he successfully completed without any side effects. A follow up colonoscopy, 6 mo after the resection, showed no residual disease. An MRI scan of the rectum was performed 9 mo after the resection and showed no recurrence of disease. After 9 mo of follow up, the patient had remained well, with no symptoms and no delayed complications from the EID procedure.

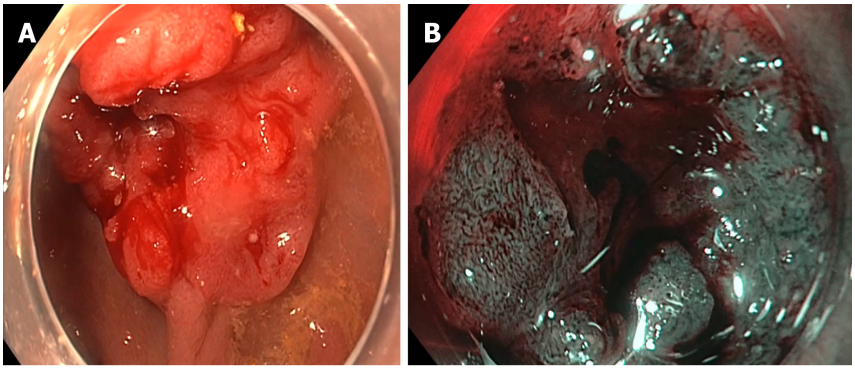

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Figure 1 Endoscopic image of the lesion. A: Lesion in white light. There is a central depression with Paris classification IIc/IIa; B: Vn type pit pattern corresponds to Narrow Band Imaging International Colorectal Endoscopic classification 3, Japan Narrow Band Imaging Expert Team classification 3 lesion.

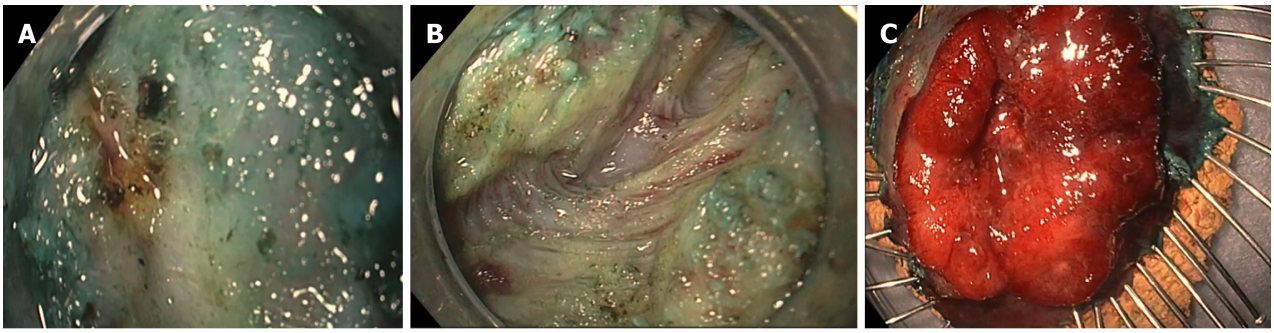

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Figure 2 Lesion during dissection and after removal. A: Significant fibrosis encountered during endoscopic intermuscular dissection; B: After dissecting the fibrotic area, the inner muscle layer was dissected, keeping the outer longitudinal layer intact; C: The tumour was released from the muscle layer and pinned on the cork board and submitted for histological analysis.

DISCUSSION

EID was first described by Rahni *et al*[13] for resection of rectal lesions with significant fibrosis. It is a new technique where a dissection is carried out of the inner circular muscle layer in the intermuscular plane, while keeping the outer longitudinal layer in the rectum intact. A recent case series of 67 patients described this technique for resection of rectal cancers with suspected invasion beyond the SM1 layer. This series concluded that EID is a feasible technique, with a technical success of 96% and a safe procedure requiring no surgery in EID related complications. 12% of patients had minor adverse events[14].

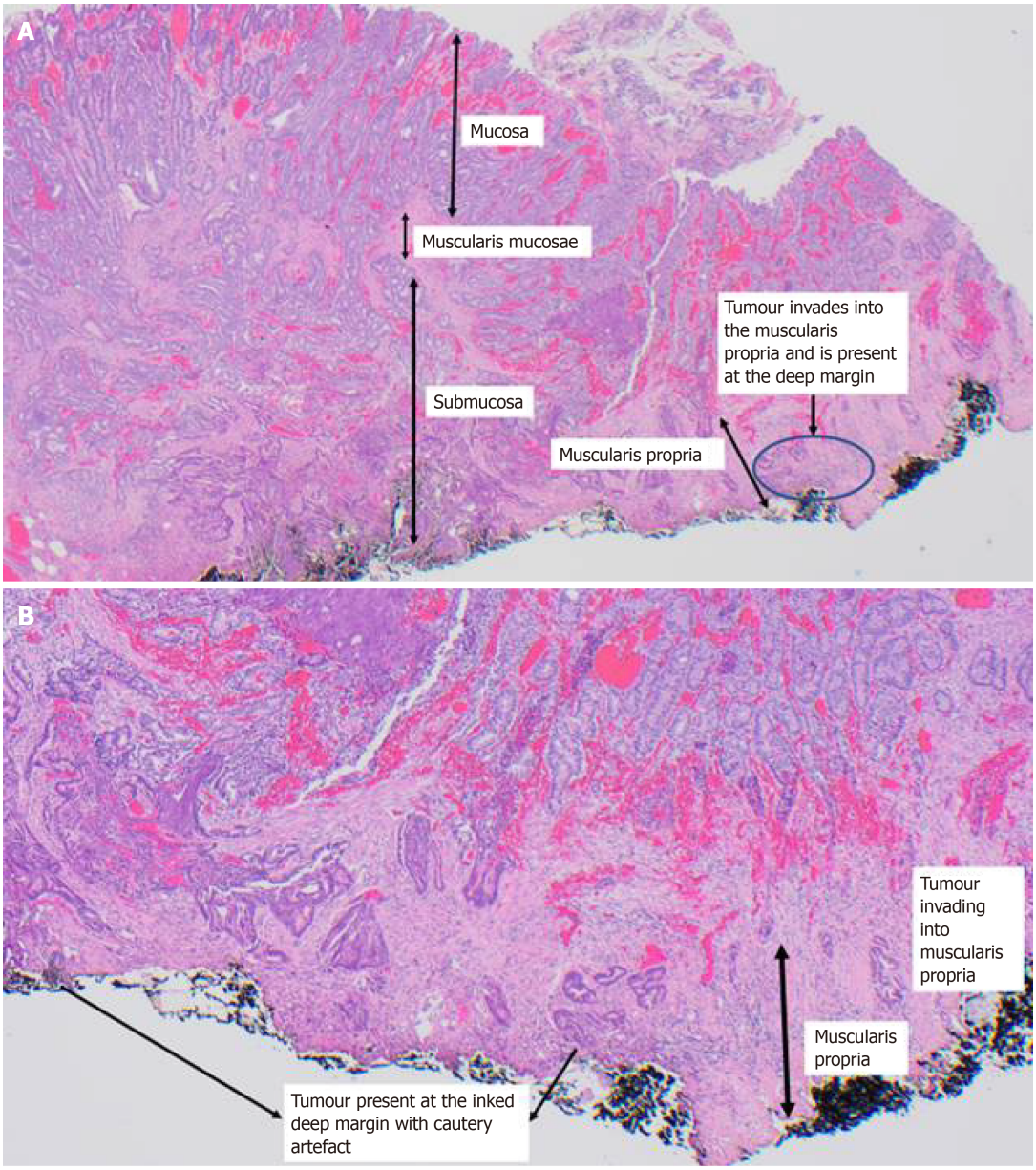
The case discussed above, was the first such procedure to be performed in New Zealand. Although the patient did not have R0 resection and ideally should have had radical surgery, his comorbidities meant that such surgery was prohibitive. Radical surgery can still be safely performed in low risk patients who have non curative ESD[15]. Our patient underwent long course chemoradiotherapy instead, with no disease recurrence after 9 mo of follow up.

There is preliminary data to suggest that patients who undergo local resection, followed by adjuvant chemoradiotherapy, can preserve their rectum and have better QoL[16]. A large, randomized trial (TESAR trial) is underway and results are awaited with interest[17]. This trial will consider this issue and, if positive, radical surgery might be avoidable for high risk patients in future.

A recent study evaluated the clinical outcome of non-curative ESD for early CRC. This study included 207 non-curative ESD cases and showed the tumour recurrence and disease specific survival rates were similar in patients who had radical surgery *vs* those who were followed up by endoscopy (after a median follow-up of 30 mo)[18]. Additional treatment decisions are often based on patient comorbidities and risks of additional treatment should be carefully weighed against the benefits. The patient discussed above was considered fit enough for long course chemoradiotherapy, with the aim to treat both the local residual disease and LNM if present.

CONCLUSION

This groundbreaking EID case, the first to be performed in New Zealand, highlights that this technique is an option worth considering for some patients. It is feasible and can be performed successfully, without any major complications, in



DOI: 10.5412/wjsp.v13.i3.22

Figure 3 Pathological analysis of the lesion. A: Endoscopic intermuscular dissection specimen, including muscularis propria. A low-grade adenocarcinoma invading into the muscularis propria as shown at the inked deep margin (at least pT2); B: Enlarged image of tumour invasion into muscularis propria.

highly selected lesions and patient groups. It can potentially offer curative local resection of rectal cancer despite deep submucosal invasion, showing favourable histopathological features in carefully selected patients.

FOOTNOTES

Author contributions: Sekra A performed the procedure and wrote the manuscript, Tan T reported the pathology and described the pathology figure in the manuscript.

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REFERENCES

1 **Wang J**, Zhang XH, Ge J, Yang CM, Liu JY, Zhao SL. Endoscopic submucosal dissection vs endoscopic mucosal resection for colorectal tumors: a meta-analysis. *World J Gastroenterol* 2014; **20**: 8282-8287 [PMID: 25009404 DOI: 10.3748/wjg.v20.i25.8282]
2 **Arthursson V**, Rosén R, Norlin JM, Gralén K, Toth E, Syk I, Thorlacius H, Rönnow CF. Cost comparisons of endoscopic and surgical resection of stage T1 rectal cancer. *Endosc Int Open* 2021; **9**: E1512-E1519 [PMID: 34540543 DOI: 10.1055/a-1522-8762]
3 **Steele SR**, Bleier J, Champagne B, Hassan I, Russ A, Senagore AJ, Sylla P, Pigazzi A. Improving outcomes and cost-effectiveness of colorectal surgery. *J Gastrointest Surg* 2014; **18**: 1944-1956 [PMID: 25205538 DOI: 10.1007/s11605-014-2643-9]
4 **Lee CM**, Huh JW, Yun SH, Kim HC, Lee WY, Park YA, Cho YB, Chun HK. Laparoscopic versus open reintervention for anastomotic leakage following minimally invasive colorectal surgery. *Surg Endosc* 2015; **29**: 931-936 [PMID: 25060688 DOI: 10.1007/s00464-014-3755-8]
5 **Eleftheriadis N**, Inoue H, Ikeda H, Onimaru M, Yoshida A, Maselli R, Santi G, Kudo S. Definition and staging of early esophageal, gastric, and Colorectal Cancer. *Journal of tumour* 2014; **18**: 161-178
6 **Pimentel-Nunes P**, Dinis-Ribeiro M, Ponchon T, Repici A, Vieth M, De Ceglie A, Amato A, Berr F, Bhandari P, Bialek A, Conio M, Haringsma J, Langner C, Meisner S, Messmann H, Morino M, Neuhaus H, Piessevaux H, Rugge M, Saunders BP, Robaszkiewicz M, Seewald S, Kashin S, Dumonceau JM, Hassan C, Deprez PH. Endoscopic submucosal dissection: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. *Endoscopy* 2015; **47**: 829-854 [PMID: 26317585 DOI: 10.1055/s-0034-1392882]
7 **Rönnow CF**, Arthursson V, Toth E, Krarup PM, Syk I, Thorlacius H. Lymphovascular Infiltration, Not Depth of Invasion, is the Critical Risk Factor of Metastases in Early Colorectal Cancer: Retrospective Population-based Cohort Study on Prospectively Collected Data, Including Validation. *Ann Surg* 2022; **275**: e148-e154 [PMID: 32187031 DOI: 10.1097/SLA.0000000000003854]
8 **Kitajima K**, Fujimori T, Fujii S, Takeda J, Ohkura Y, Kawamata H, Kumamoto T, Ishiguro S, Kato Y, Shimoda T, Iwashita A, Ajioka Y, Watanabe H, Watanabe T, Muto T, Nagasako K. Correlations between lymph node metastasis and depth of submucosal invasion in submucosal invasive colorectal carcinoma: a Japanese collaborative study. *J Gastroenterol* 2004; **39**: 534-543 [PMID: 15235870 DOI: 10.1007/s00535-004-1339-4]
9 **Nakadoi K**, Tanaka S, Kanao H, Terasaki M, Takata S, Oka S, Yoshida S, Arihiro K, Chayama K. Management of T1 colorectal carcinoma with special reference to criteria for curative endoscopic resection. *J Gastroenterol Hepatol* 2012; **27**: 1057-1062 [PMID: 22142484 DOI: 10.1111/j.1440-1746.2011.07041.x]
10 **Sohn DK**, Chang HJ, Park JW, Choi DH, Han KS, Hong CW, Jung KH, Kim DY, Lim SB, Choi HS, Jeong SY. Histopathological risk factors for lymph node metastasis in submucosal invasive colorectal carcinoma of pedunculated or semipedunculated type. *J Clin Pathol* 2007; **60**: 912-915 [PMID: 16997919 DOI: 10.1136/jcp.2006.043539]
11 **Oka S**, Tanaka S, Nakadoi K, Kanao H, Chayama K. Risk analysis of submucosal invasive rectal carcinomas for lymph node metastasis to expand indication criteria for endoscopic resection. *Dig Endosc* 2013; **25** Suppl 2: 21-25 [PMID: 23617644 DOI: 10.1111/den.12089]
12 **Watanabe D**, Toyonaga T, Ooi M, Yoshizaki T, Ohara Y, Tanaka S, Kawara F, Ishida T, Morita Y, Umegaki E, Matsuda T, Sumi Y, Nishio M, Yokozaki H, Azuma T. Clinical outcomes of deep invasive submucosal colorectal cancer after ESD. *Surg Endosc* 2018; **32**: 2123-2130 [PMID: 29098429 DOI: 10.1007/s00464-017-5910-5]
13 **Rahni DO**, Toyonaga T, Ohara Y, Lombardo F, Baba S, Takihara H, Tanaka S, Kawara F, Azuma T. First reported case of per anal endoscopic myectomy (PAEM): A novel endoscopic technique for resection of lesions with severe fibrosis in the rectum. *Endosc Int Open* 2017; **5**: E146-E150 [PMID: 28337484 DOI: 10.1055/s-0042-122965]
14 **Moons LMG**, Bastiaansen BAJ, Richir MC, Hazen WL, Tuynman J, Elias SG, Schrauwen RWM, Vleggaar FP, Dekker E, Bos P, Fariña Sarasqueta A, Lacle M, Hompes R, Didden P. Endoscopic intermuscular dissection for deep submucosal invasive cancer in the rectum: a new endoscopic approach. *Endoscopy* 2022; **54**: 993-998 [PMID: 35073588 DOI: 10.1055/a-1748-8573]
15 **Chen T**, Zhang YQ, Chen WF, Hou YY, Yao LQ, Zhong YS, Xu MD, Zhou PH. Efficacy and safety of additional surgery after non-curative endoscopic submucosal dissection for early colorectal cancer. *BMC Gastroenterol* 2017; **17**: 134 [PMID: 29183272 DOI: 10.1186/s12876-017-0701-y]
16 **Coco C**, Magistrelli P, Netri G, Cogliandolo S, Carbone L, Morganti AG, Ziccarelli L, Valentini V. Combined modality therapy in low risk (T2N0) rectal cancer. *Rays* 1995; **20**: 156-164 [PMID: 7480864]
17 **Borstlap WA**, Tanis PJ, Koedam TW, Marijnen CA, Cunningham C, Dekker E, van Leerdam ME, Meijer G, van Grieken N, Nagtegaal ID, Punt CJ, Dijkgraaf MG, De Wilt JH, Beets G, de Graaf EJ, van Geloven AA, Gerhards MF, van Westreenen HL, van de Ven AW, van Duijvendijk P, de Hingh IH, Leijtens JW, Sietses C, Spillenaar-Bilgen EJ, Vuylsteke RJ, Hoff C, Burger JW, van Grevenstein WM, Pronk A, Bosker RJ, Prins H, Smits AB, Bruin S, Zimmerman DD, Stassen LP, Dunker MS, Westerterp M, Coene PP, Stoot J, Bemelman WA, Tuynman JB. A multi-centred randomised trial of radical surgery versus adjuvant chemoradiotherapy after local excision for early rectal cancer. *BMC Cancer* 2016; **16**: 513 [PMID: 27439975 DOI: 10.1186/s12885-016-2557-x]
18 **Spadaccini M**, Bourke MJ, Maselli R, Pioche M, Bhandari P, Jacques J, Haji A, Yang D, Albéniz E, Kaminski MF, Messmann H, Herreros de Tejada A, Sferrazza S, Pekarek B, Rivory J, Geyl S, Gulati S, Draganov P, Shahidi N, Hossain E, Fleischmann C, Vespa E, Iannone A, Alkandari A, Hassan C, Repici A; ESD Western Alliance (EWA). Clinical outcome of non-curative endoscopic submucosal dissection for early

colorectal cancer. *Gut* 2022 [PMID: 35058275 DOI: 10.1136/gutjnl-2020-323897]

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