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Role of Endoscopy in osteolytic bone lesion management

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ABSTRACT

Background: Although benign bone tumors, osteomyelitis, and locally malignant tumors are potential to be locally aggressive. Various treatment approaches, such as aspiration and injection, en bloc resection, open curettage, and other methods like sclerotherapy, and embolization are described but the most appropriate treatment should be selected after considering the risk of tumor recurrence and treatment complications. Endoscopic curettage (ESC) may be a less invasive alternative to open curettage for benign bone tumors, locally malignant swelling and osteomyelitis with minimal complications and good function output.
Aim of the work: to describe the use of ESC for the treatment of bone lesions and report my clinical outcomes, including the rate of recurrence, time to consolidation, complications, and functional outcomes.
Patients and Methods: Between March 2017 and April 2019 patients 40 patients underwent ESC for the treatment of osteocytic lesion (benign , locally malignant and osteomyelitis) at our unit with mean postoperative follow-up, 24 months. ESC was performed with extended curettage with or without bone graft or cement. The modified Neer classification And MSTS scoring system were used for follow up.
Results: By MSTS scoring system, 39 had have excellent results and the remaining 11 case had persistent pain duo to some reason. The modified Neer classifications was used for follow up. There is no relation between tumor size and recurrence.
Conclusion: Endoscopy plays a role of good visualization, assessment and decrease recurrent rate with good functional outcomes.

Keywords: *Endoscopic curettage; Osteomylitis; Bone tumor; bone cyst; Endoscopy.*

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INTRODUCTION

Benign osteolytic lesions of bone occur in a wide range of clinical and pathological manifestations, ranging from the benign to the violent and destructive, with the ability to turn into high-grade malignancy and even produce metastases.[1]

Usually painless lesions, however, pathological fracture can be occurred in large lesions. Swelling, pain, and painful range of motion in lesion near the joint are documented. The goal of treatment is to alleviate these symptoms while still preventing the pathological fracture and to halt the lesion's progression. [2]

Marginal excision, wide block excision, and intralesional excision (curettage with or without burring or adjuvant therapy) have all been described as treatment options to achieve this therapeutic objectives.[1, 3, 4]

Endoscopic Management has been reported in few articles. It's been used to treat cystic lesions of the metatarsal, calcaneus, [1,5] and talus, Murphey, MD. [(6)] Endoscopic assisted curettage (ESAC) was proposed as an assisted method with curettage for the management of benign and low-grade malignant osteolytic lesions, as well as chronic osteomyelitis, and the surgical and clinical results of this therapy technique were reviewed.

PATIENTS AND METHODS

Patient

From march 2017 to April 2019 , we prospectively screened 40 patients (17 male 42.5% and 23 female 57.5%) with benign , low grade chondrosarcoma lesions and chronic osteomylitis, in long and small bone of different anatomic locations and histopatological varieties (Table 1), all were treated at surgical oncology unit, Orthopedic department, Al-Azhar University Hospitals.

No.	Age/ sex	PORTALS	Tum	Pathol-ogical fracture	Procedures with or without bone graft, site of bone graft	Fu	Near to articular surface	Complicat-ion	Consolida-tion time In months	MS TS	Operative time	Neer
1	25m	2	Enchondroma / mcb		CURRE/ BONE GRAFT, DR	12	Yes	No	5		40	A
2	34f	2	Enchondroma / mcb		CURRE/ fibula BONE GRAFT, DR	22	no	No	4		44	B
3	24f	2	Enchondroma / mcb		CURRE/ BONE GRAFT, DR	44	No	No	5		40	A
4	17f	2	Enchondroma / mcb		CURRE/ BONE GRAFT, DR	51	No	No	3		55	A
5	22m	2	Enchondroma / mcb	Yes	CURRE/ FIXATION BONE GRAFT, DR	16	No	No	4		38	A
6	19f	2	Enchondroma/ mtc		CURRE/ BONE GRAFT, DR	16	No	No	3		40	A
7	28m	3	Enchondroma/ mtc		CURRE/ fibular BONE GRAFT, DR	22	yes	No	5		54	A
8	9 f	3	Enchondroma/ mtc	Yes	CURRE/ FIXATION, BONE GRAFT,PROX. ULNA	19	No	Fracture	3		60	A
9	7f	3	Enchondroma/ mtc		CURRE/ BONE GRAFT, PROX ULNA	19	no	No	3		44	A
10	22f	2	Enchondroma/mtc		CURRE/ fibular BONE GRAFT,	34	No	No	7		50	B
11	24f	2	Enchondroma/mtc	Yes	CURRE/FIXATIO	15	No	S INFECTIO N	5		55	A
12	30m	2	Enchondroma/mtc		CURRE/ BONE GRAFT, DR	25	No	Transient radial nrve palsy	8		60	B
13	20f	2	Enchondroma/ph	Yes	CURRE/ fixation and BONE GRAFT,PROX. ULNA	28	yes	No	6		50	A
14	23m	2	Enchondroma/DISTAL RADIUS		CURRE/ GRAFT	15	No	TENDENI TIS	7		48	B
15	30m	2	Enchondroma /ph		CURRE/ BONE GRAFT, DR	17	No	No	8		50	A
16	28m	3	Enchondroma/ ph	Yes	CURRE/ fix and bone graft,DR	30	no	Pin tract infection	9		49	A
17	33f	2	Enchondroma/ ph		CURRE/GRAFT	30	no	No	6		50	A
18	24 M	2	Enchondroma/ ph		CURRE/ GRAFT	45	No	No	8		40	A
19	19M	2	Enchondroma/ ph		CURRE/ BONE GRAFT,PROX. ULNA	29	No	No	9		44	A
20	26M	3	Enchondroma/ ph		CURRE/ GRAFT	35	No	No	6		50	A
21	34F	4	CHRONIC OSTEOMYLITIS PH		CURRE/ cement	12	No	LATE RECURRE NCE	12		120	0
22	20F	4	CHRONIC OSTEOMYLITIS DISTAL FEMUR		CURRE/ FIXATION, cement	15	Yes	No	--		120	--
23	72f	3	Chondrosarcoma/ proximal Humerus		CURRE/ cement and fixation	19	no	No	---		120	--
24	45f	3	Chondrosarcoma distal femur		CURRE/ cement and fixation	27	Yes	No	---		110	----
25	34f	3	Giant cell tumor/ proximal tibia		CURRE/ BONE cement	25	yes	No	---		70	--
26	33f	3	GCT/ distal femur		CURRE/ BONE cement	25	Yes	No	---		80	--
27	28m	3	GCT/ proximal tibia	Yes	CURRE/ fixation and BONE cement	40	yes	No	---		90	--
28	24f	3	GCT/ proximal tibia		CURRE/ BONE cement	25	Yes	No	---		100	--
29	41 m	4	Fibrous dysplasia/ PROXIMAL FEMURE		CURRE/ plate fix,BONE GRAFT	44	no	Deled union	10		110	B
30	17 F	3	Fibrous dysplasia /prox HUM		CURRE/ BONE GRAFT	37	yes	No	12		90	B
31	36f	3	Aneurysmal/ proximal femur		CURRE/FIBULA BONE GRAFT	36	yes	No	6		100	B
32	29m	4	Aneurysmal/ proximal femur		CURRE/ fixation FIBULA BONE GRAFT	25	yes	Early painful hip ROM	8		110	B
33	12m	2	Aneurysmal/ distal radius		CURRE/ FIBULA BONE GRAFT	33		No	4		100	B

34	21f	2	Aneurysmal/ distal radius		CURRE/ BONE GRAFT	11	no	EARLLY STIFF WRIST	7		60	A
35	35m	2	Aneurysmal/ distal radius		CURRE/ BONE GRAFT	13	No	No	11		66	B
36	16f	3	Aneurysmal/ proximal femur		CURRE/FIBULA BONE GRAFT	24	no	Delayed union	22		70	C
37	27f	2	Osteoblstoma/ PROX HUM		CURRE/ BONE GRAFT	25	yes	No	7		66	A
38	43m	2	Osteoblstoma/ PROX FEMUR		CURR/ CEMENT	18	no	No	---		60	--
39	23m	2	RECURRENT Osteoblstoma/PRO HUM		CURRETAGE AND CEMENT	6	yes	No	-----		90	--
40	22 f	2	Osteoblstoma/ PROX HUM		CURRETAGE AND BONE GRAFT	13	yes	Recurrence	14		66	D

Table 1: Patients distribution.

The inclusion criteria of the cases includes both sex, age more than 7 years and lesion at small and long bone, and exclusion criteria were, less than 7 years old, high grade malignant lesions, and lesion at flat bone.

Full Tumor work up had done in most of cases and after biopsy, all were benign in nature and two case were low grade chondrosarcoma, and 2 cases of chronic osteomyelitis, some cases with pathological fracture (6 cases) at first presentation and we had to wait 4–5 weeks for the cavities to be closed to prevent fluid leakage. All 40 cases were treated with ESC (endoscopic curettage). The mean overall follow-up period was (24.9- 10.7) months.

Surgical steps,

All patients provided informed consent in accordance with the guidelines established by our hospital's ethical committee. Preoperative planning of surgical approaches, portals, type of anesthesia, and type of fixation are important. Regional or general anesthesia, and tourniquet with C-RM magnification, aspiration in some cases like aneurysmal bone cyst reveal bloody lesion (figure d and e), surgically safe mini incision were done with blunt dissection up to bone, drill bit 3.5 to incisions sites was protected by sleeve, blind curettage by curette (figure f), or by universal incision for large or deep lesions, H2O2 was used as adjuvant therapy (figure 3 g) followed by An 2.7 or 4.0 mm 30 angled camera at one portal and curette to another one and Finally the curette was replaced by high speed curette (figure 3 h), to remove of all remnant membrane (fig 3 i), and allowing excision of 1 to 2 mm of the endosteum and bony septa and finally, Saline washing to remove any debris and endoscopic confirmation of all lesion boundaries. The degree of curettage of the lesion has been explicitly verified on gross inspection using an endoscopy, that was also verified using an X-ray magnifier and depending on hemorrhagic results. After the extended curettage of bone lesions, the bone graft was done utilizing autologous bone which was extracted from the graft donor site as ilium, distal radius, proximal ulna and or proximal tibia, or allograft Confirmation of bone graft filling space by endoscope and by X-ray magnifier. Fixation was done to protect the weak bone or in large metaphysical or diaphysis lesions. Bone cement in another cases of low grade sarcomas or osteomyelitis with or without antibiotic added as well.

Postoperative evaluation

Following surgery, the operated limb has been immobilized by a strip and taped, no weight bearing for 2 to 8 weeks according to lesion site and healing activity. All patients were prepared for postoperative follow up visits, which included radiographs and clinical evaluations every two weeks for the first two months, and then every three and six months following operation. The MSTS (Musculoskeletal Tumor Society Score) has been applicate to assess postoperative complications and functional recovery.[7]

A surgeon who is the A dependent examiner who performs the necessary clinical assessments including pain evaluation by pain visual analog scale (VAS), with ten points representing the most severe pain and joint range of motion. 2 views of X- ray for bone healing, graft resorption and lesion recurrence. Bone union has been described by medical evidence of pain relief in the lesion region and radiographic evidence of bone healing in both views, in the form of bone trabeculae crossing the fracture site. The criteria of Hou et al. to evaluate bone healing time after ESC, [8] and Cyst consolidation. The updated Neer classification was used to classify the final assessment [8, 9] (Table 2). After bone healing, patients start doing physiotherapy to guard against stiffness that can develop during the period of splinting.

A	Healed Cyst filled with new bone with small radiolucent area	(< 1 cm)	18 cases
B	Healed with a defect Radiolucent area	(< 50% diameter) with enough cortical thickness	9
C	Persistent cyst Radiolucent area	(≧50% diameter) with thin cortical rim	2
D	Recurrent cyst or Cyst reappearing in the obliterated area or in the increased residual radiolucent area	Recurrence	1

Table 2: Modified Neer classification. Classification description details.

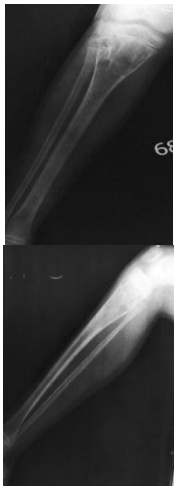
a

b

i

j

Fig. 1. Child 5 years old with aneurysmal bone cyst proximal tibia, (a and b) bone swelling and syringe aspiration, (c,d and e) x- ray, CT and MRI, (f) currettage, (g) H_2O_2 irrigation, (h) endoscopic curettage, (I) after curettage membrane, (j) post x-ray.



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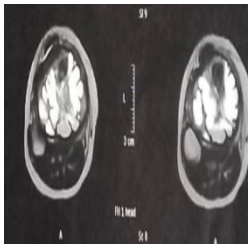

e

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a

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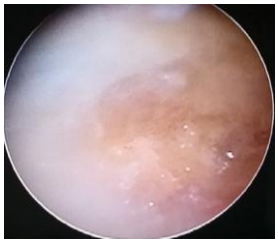

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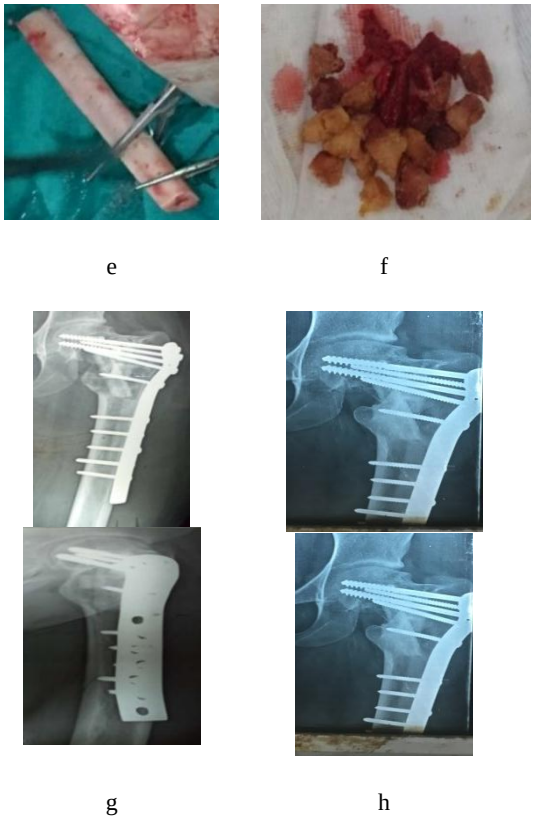

Figure 2: Girl 13 years old with recurrent aneurysmal a bone cyst proximal femur treated previously by open curettage and screws fixation, (a) bone swelling, (b,c and d) endoscopic curettage, (e) fibular graft, (f) allograft, (g) post-operative x-ray, (j) after 6 months x-ray.

RESULTS

The average age was (26.9 _ 11.2), the median operative time was 68.9_ 26.3 Minutes (range 38 min to 120 minutes), and mean follow up was 24.9_10.7 months.

Size of the lesion is the key of portal numbers, among the 40 patients, an average of two portals were used. Four portals in 4 instances (10%), three portals in 14 instances (35%), and two portals in 22 instances (55%). There were 30 cases treated by extended curettage with or without graft, and 10 patients were treated by curettage and cement application

Early follow up, Almost all patients were assisted by MSTS scoring system, it is simple and brave to assess physical function of both upper and lower limb tumors, with the exception of 11 patients who indicated persistent pain, excellent function following ESC became (MSTS = 30) and or stiff joints due to tumor recurrence in 2 patients, iatrogenic intraoperative fracture in one case, 2 patient with tendenitis, 2 patient with lesion near to the joint, 1 patients with delayed union, and 2 cases of superficial infection treated by antibiotics and one case of Transient radial nerve palsy treated by physiotherapy. During the follow-up period, the rate of recurrence following ESC was found in 2 case (16.7%) one case of proximal humerus osteoblastoma, with a curative outcome achieved with repeated of open curettage and bone cement, and another one case of osteomyltis which are managed by revisions .The average time for consolidation after ESC in 28 cases was 7.3_3.95 months, and delayed union in 1 cases.

For 30 PT out of 40 instances, the updated Neer classifications of the final status following ESC were as follows. There were 28 instances of class A-B (healed cysts) and one instance of class C (persistent cysts) (evaluated by H.A.). And one case of recurrence and There is no relation between tumor size and recurrence.

DISCUSSION

I was given the surgical and clinical results of a reasonably large case series of patients treated with ESC for benign bone lesions, low-grade sarcomas, and osteomyelitis. With a tumor recurrence rate of 40 to 90 %, open curettage and defect reconstruction with bone graft or bone cement, as defined by Jaffe et al. [10] remains the staple of modern therapy of benign bone lesions. In our study the recurrence rate was (17%) less than open curettage. To enhance local control and reduce the rate of recurrence, high-speed burring or chemical therapy (including the usage of liquid nitrogen or polymethylmethacrylate) have been introduced as choices for the elimination of micro-residue tumors.[11,12] Endoscopy has the benefit of precisely evaluating tumor resection by inspecting the bone marrow cavity directly for complete cyst removal (so if probable) without surrounding soft tissue damage and prevent other complications like excessive curettage or blind spot. [13,14]

The procedure is more aesthetically pleasing and less invasive compared to open procedures that it can perform via small holes, with preservation of the bone. ESC may be a suitable choice for the therapy of osteolytic bone lesions, despite the longer procedure time attributable to holes preparation and careful piece-by-piece curettage to prevent unnecessary curettage or residual tumor.

Since 1990, minimally invasive approaches to the therapy of enchondromas, unicameral bone cysts, and chondroblastomas were preferred.[15, 16] Moreover, Errani, et al. described their experiences with knee chondroblastoma endoscopic therapy allowing much visualization while avoiding violating the joint surface [17] with good outcome in the form of healing time consolidation and recurrence rate as well as our study.

By activating healthy bone marrow directly, the main aim of ESC is to obtain full lesion resection and promote new bone formation. Curopsy, known as percutaneous limited curettage with endoscopy at the biopsy time, was identified by Reddy et al. [18] as a feasible method to resecting the membrane lining the cyst with end results (a 16.7% recurrence rate and a 7.3 ± 3.95 month period to bone healing). Our findings were similar to theirs (10 % recurrence rate following ESC). I hypothesized, like Curopsy, that ESC stimulated bone healing after tiny holes were

penetrated, and that it was successful in eliminating tumor cell membranes. There is no rapid activation of tumor lesion after ESC and we suggest that ESC achieve total removal of residual tumor. We had a case of iatrogenic fracture during surgery and were treated by K. wire fixation, at the moment; it is difficult to foresee pathological fractures with benign active bone tumors in pediatric, [19] and or adults. We considered a lesion in the trochanteric area to be a contraindication to ESC in other research but I had a chance to perform fixation to prevent pathological fractures at first, followed by Esc extended curette and a fibular graft. In fact, we have a case of a transient radial nerve palsy, with good recovery. To prevent complications with ESC, preoperative preparation is critical, which includes determining the patient's location and portal positions in order to avoid neurovascular damage and pathological fractures.

Our research had certain limitations that should be recognized. First, to compare with open surgical interference, use of flexible camera rather than fixed one, long term follow up, finally, need a high learning curve to use ESC.

CONCLUSION

Benign bone tumors and low gad sarcomas are a group of neoplasms which is most common in children and young adults, but they can also appear later in life as well as osteomyelitis. Patient history and x ray are the gold issue for early diagnosis. Tumor work up is mandatory for lesion personality. For the majority treatment up to surgical interferences is only reported in symptomatic patients or where there is a risk of pathological fracture or malformation. Endoscopy play a role of good visualization, assessment and decrease recurrent rate with good functional outcomes.

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