



**PROJECT: Tumors at the elbow – clinical and oncological results  
after resection and endoprosthesis replacement**

**Study protocol**

Inclusion criteria

- patients with primary or secondary bone tumor or soft-tissue tumor near elbow
- resection involving elbow joint (distal humerus, proximal ulna, total humerus, both intra- and extraarticular elbow resection)
- reconstruction performed with a tumor endoprosthesis (Implantcast MUTARS, Stryker/Howmedica, Stanmore, Zimmer, Biomet, custom-made or other)
- index operation at year 1990 or after
- minimal follow-up: 6 months (or less if the patient died)
- provide surgery and/or complication data, even if patient is lost in follow-up or not possible to provide clinical performance / scores' info

Output data

- surgical outcome
  - o local tumor control at resection
  - o intraoperative complications
- oncological outcome
  - o local recurrence
  - o metastasis
  - o survival
  - o general outcome (MSTS, TESS)
- endoprosthetic outcome
  - o clinical performance (MEPS)
  - o range of motion
  - o complications
  - o direct comparison of various implants



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**Legend for the Excel Table Datasheet**

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**General data**

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Country	Country
City	City
Hospital	Hospital / University
Patient ID	a local patient identification number; must not contain patients' data

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**Patient / tumor data**

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DOB	patient's date of birth, format: mm/yyyy
Index OP date	date at index surgery / date at tumor resection, format: mm/yyyy
Age at resection	years
Gender	M / F
Diagnosis	histologically confirmed diagnosis at index operation
Side	L / R
Tumor localization	Primary tumor localization / origin H – humerus U – ulna R – radius S - soft tissue near elbow
Tumor size	maximal length of tumor, mm
Metastasis at diagnosis	metastasis at diagnosis, y/n If y, state where (lung, nodes, bone...)
Radiotherapy	0 – no 1 – preoperative 2 – postoperative 3 – intraoperative
Chemotherapy	0 – no 1 – preoperative 2 – postoperative 12 – pre- and postoperative

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**Surgery data**

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Bone resected	H – humerus U – ulna R – radius - state all that apply (for example HU for resection of both humerus and ulna) - resurfacing for endoprosthesis implantation does not apply
Resection humerus	length of humerus resection, mm
Resection ulna	length of ulna resection, mm
Resection type	IA – intraarticular EA – extraarticular
Surgery plan	C – curative P – palliative
Nerve resection (planned)	R – n. radialis M – n. medianus U – n. ulnaris
Soft tissue resection (planned)	BR – m. brachialis BB – m. biceps brachii TB – m. triceps brachii
Vascular resection (planned)	vascular resection, vascular graft used, format: y/n
Endoprosthesis	Endoprosthesis type: Mut – Implantcast MUTARS Stan – Stanmore Stry – Stryker GMRS How – Howmedica HMRS Bio – Biomet CM – custom made O – other (state which)
Allograft	y/n
EP length	length of endoprosthesis replacing the resected bone (usually less than resection), format: mm
Humerus fixation	0 – cementless 1 – cemented
Ulna fixation	0 – cementless 1 – cemented
<b>Intraoperative complications</b>	
Tumor resection	W – wide M – marginal I – intralesional

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I-OP nerve injury	Intraoperative nerve injury R – n. radialis M – n. medianus U – n. ulnaris P – permanent T – transitory (resolved after, format: months) Example: RT (3m)
I-OP arterial injury	Intraoperative arterial injury format: y/n If y, S - suture, VG - vascular graft
I-OP fracture	Intraoperative fracture format: y/n If y, H – humerus, U – ulna, R – radius
Classification of failure	
	Classification of failure (Handerson, BJJ 2014) format "no" or "describe in detail"
1A	mechanical - soft tissue - limited function - insufficient musculolig. attachment
1B	mechanical - soft tissue - aseptic wound dehiscence
2A	mechanical - aseptic loosening - early (<2y after implantation)
2B	mechanical - aseptic loosening - late (>2y after implantation)
3A	structural - implant breakage or wear
3B	structural - periprosthetic osseous fracture
4A	infection - early (<2y after implantation); if y, state microorganism
4B	infection - late (>2y after implantation); if y, state microorganism
5A	tumor progression - soft-tissue progression of tumour
5B	tumor progression - bony progression of tumour
6A	paediatric - physeal arrest - growth arrest resulting in longitudinal or angular deformity
6B	paediatric - joint dysplasia - dysplastic joint resulting from articulation with implant
<b>Reoperations</b>	
Number	Number of elbow / tumor / endoprosthesis reoperations
Reason	State the reason for each reoperation and a time (months) from index operation



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<b>Specific scores and outcome</b>	
MSTS	Musculoskeletal Tumor Rating Scale (MSTS) at the last follow-up - scroll down for a MSTS questionnaire - possible MSTS result: 0 to 30
TESS	TESS at the last follow-up - scroll down for a TESS questionnaire - calculate % (excluding N/A answers) - possible TESS result: 0% to 100%
MEPS	Mayo Elbow Performance Score (MEPS) at the last follow-up - scroll down for a MEPS questionnaire - caution: at "function" summarize all that apply (max 25 points) - possible MEPS result: 0 to 100
Range of motion	format: extension to flexion example 1: if hyperextension 5° and flexion 120°, write " -5 to 120 " example 2: if flexion contracture 20° and flexion 80°, write " 20 to 80 "
Follow-up	follow-up from index operation until the last control, format: months
Date last f-up	last follow-up date, format: mm/yyyy
Local recurrence	known local recurrence till the last follow-up format: y/n If y, how many months after index surgery
Late METs	late metastasis, known to the last follow-up format: y/n If y, state when (months) and where (lung, nodes, bone...)
Final outcome	NED – no evidence of disease AWD – alive with disease DOD – died of disease RIP – died of other cause, not related to index elbow tumor LIF – lost in follow-up
Comment	if needed

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**Attachment 1.**

Musculoskeletal Tumor Rating Scale (MSTS):  
upper extremity

Score	Pain	Function	Emotional acceptance	Hand positioning	Manula dexterity	Lifting ability
5	none	no restriction	enthused	unlimited	normal	normal
4	(intermediate)	(intermediate)	(intermediate)	(intermediate)	(intermediate)	(intermediate)
3	modest	recreational restriction	satisfied	not above shoulder or no pro-supination	loss of fine movements	limited
2	(intermediate)	(intermediate)	(intermediate)	(intermediate)	(intermediate)	(intermediate)
1	moderate	partial disability	accepts	not above waist	cannot pinch	helping only
0	severe	total disability	dislikes	none	cannot grasp	none

Ref: Enneking WF, Dunham W, Gebhardt MC, Malawar M, Pritchard DJ. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. Clin Orthop Relat Res. 1993 Jan;(286):241-6.

**Attachment 2.**

Toronto Extremity Salvage Score (TESS)

	impossible to do (1 point)	extremely difficult (2 point)	moderately difficult (3 points)	a little bit difficult (4 points)	not at all difficult (5 points)	not applicable ( / )
1. Putting on a pair of pants is	1	2	3	4	5	/
2. Tying shoe laces	1	2	3	4	5	/
3. Putting on socks or stocking	1	2	3	4	5	/
4. Showering	1	2	3	4	5	/
5. Dressing my arms and upper body	1	2	3	4	5	/
6. Buttoning a shirt	1	2	3	4	5	/
7. Tying a tie or a bow at the neck of a blouse	1	2	3	4	5	/
8. Putting on make-up or shaving	1	2	3	4	5	/
9. Brushing your teeth	1	2	3	4	5	/
10. Brushing your hair	1	2	3	4	5	/
11. Doing light household chores	1	2	3	4	5	/
12. Gardening or yard work	1	2	3	4	5	/
13. Preparing and serving meals	1	2	3	4	5	/
14. Cutting food while eating	1	2	3	4	5	/
15. Drinking from a glass	1	2	3	4	5	/
16. Performing heavy household chores	1	2	3	4	5	/
17. Going shopping	1	2	3	4	5	/
18. Giving or receiving change (ie. coins or bills)	1	2	3	4	5	/
19. Carrying a shopping bag or briefcase	1	2	3	4	5	/
20. Lifting a box to an overhead shelf	1	2	3	4	5	/
21. Turning a key in a lock	1	2	3	4	5	/

22. Pushing or pulling open a door	1	2	3	4	5	/
23. Writing	1	2	3	4	5	/
24. Picking up small items	1	2	3	4	5	/
25. Completing my usual duties at work	1	2	3	4	5	/
26. Working my usual number of hours	1	2	3	4	5	/
27. Participating in my usual leisure activities	1	2	3	4	5	/
28. Socializing with friends and family	1	2	3	4	5	/
29. Participating in my usual sporting activities	1	2	3	4	5	/
30. Considering all the activities in which I participate in daily life, I would rate my ability to perform these activities during the past week as	1	2	3	4	5	/
31. I would rate myself as being	1	2	3	4	5	/

**CALCULATE: a total questionnaire score in %**

Ref: Davis AM, Wright JG, Williams JJ, Bombardier C, Griffin A, Bell RS. Development of a measure of physical function for patients with bone and soft tissue sarcoma. Qual Life Res. 1996 Oct;5(5):508-16.



**Attachment 3.**

The Mayo Elbow Performance Score (MEPS)

<b>Function</b>	<b>Definition</b>	<b>Points</b>
Pain	None	45
	Mild	30
	Moderate	15
	Severe	0
Motion	Arc > 100°	20
	Arc 50°-100°	15
	Arc <50°	5
Stability	Stable	10
	Moderate instability	5
	Gross instability	0
Function  (sum all that apply)	Comb hair	5
	Feed	5
	Hygiene	5
	Wear shirt	5
	Wear shoes	5

Ref: Morrey BF, Adams RA. Semiconstrained arthroplasty for the treatment of rheumatoid arthritis of the elbow. J Bone Joint Surg Am. 1992 Apr;74(4):479-90.