CT-Guided Percutaneous Bone Biopsy with a Battery-Powered Bone Access System. A Propensity Score Matched Analysis

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Objectives:

To evaluate and compare the efficacy of a battery powered bone access system (Arrow OnControl) with manual drilling in CT-guided bone biopsy. Radiation dose reduction would also be assessed.

Methodology:

A retrospective study included patients undergoing CT-guided bone biopsy from Apr 2016 to May 2018 (n=37). Indications for biopsy included suspected primary / metastatic bone neoplasm and suspected spine infection. All patients with bone biopsy performed using a battery powered bone access system were included in the study group (On-control group). A matched group (manual drilling) was derived from the same cohort by propensity score matching (Manual-drilling group). The radiation dose, procedure time, diagnostic yield and accuracy were evaluated. All bone biopsy results were compared with subsequent clinical, imaging follow-up and re-biopsy results if applicable.

Results:

Patients' demographics before and after propensity score matching were shown in Table 1. There were significant differences on radiation doses (mean CT fluoroscopy dose, total CT dose index and total dose length product) and procedure time between two groups (Table 2). The diagnostic yield and accuracy for On-control group were 93.7% and 75% respectively. The diagnostic yield and accuracy for Manual-drilling group were 75% and 87.5% respectively. Sensitivity and specificity were 71.4% and 100% in both groups. No major complication was observed in both groups.

Table 1: Patients' demographics characteristics

	Before Propensity-score matching		p value	After Propensity-score matching		p value
	On-Control Group (n=16)	Manual-drilling group (n=21)		On-Control Group (n=16)	Manual-drilling group (n=16)	
Age (mean ± SD)	63.9 ± 15.9	71.1 ± 12.9	.034@	63.9 ± 15.9	69.7 ± 9.7	.222@
Sex	Male = 10 Female = 6	Male = 18 Female = 3	.01#	Male = 10 Female = 6	Male = 13 Female = 3	.500#
Lesion consistency			.035#			.210#
Lytic	6	4		6	4	
Sclerotic	7	3		7	3	
Mixed	2	10		2	5	

SD = Standard deviation
@ = independent samples t-test
# = Fisher's Exact test

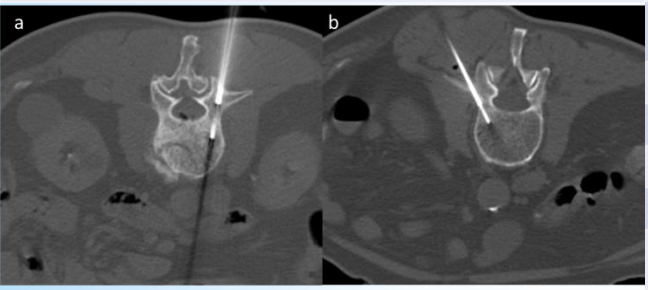

Figure a: CT guided lumbosacral spine biopsy of a 64/M using battery powered bone access system. CT fluoroscopy dose, total CT dose index, total dose length product and procedure time = 103mGy, 143.4mGy, 1417mGycm and 25min respectively. Final diagnosis was osteoporotic vertebral collapse.
Figure b: CT guided lumbosacral spine biopsy of a 67/M using manual drilling. CT fluoroscopy dose, total CT dose index, total dose length product and procedure time = 192mGy, 232mGy, 1086mGycm and 72min respectively. Final diagnosis was benign sclerotic lesion (static in CT in 1 year interval, not shown).

Table 2: Lesions, biopsy characteristics and radiation dose parameters (after Propensity-score matching)

	On-Control Group (n=16)	Manual-drilling group (n=16)	p value
Maximal diameter of lesion (cm) (mean ± SD)	2.18 ± 1.04	2.13 ± 1.20	.940@
Number of biopsy cores (median / IQR)	2 / 1	2 / 1	.323$
Lesion location			.014#
Pelvis	9	4	
Thoracic spine	0	6	
Lumbar spine	4	6	
Sacrum	1	0	
Lower limb	1	0	
Upper limb	1	0	
Maximal core length of pathological specimens (mm) (mean ± SD)	11.25 ± 8.21	12.23 ± 15.25	.827@
CT Fluoroscopy dose (mGy) (mean ± SD)	79.35 ± 50.61	120 ± 46.99	.025@
Total CTDIvol (mGy) (mean ± SD)	120.82 ± 58.1	158 ± 49.32	.040@
Total DLP (mGycm) (mean ± SD)	978.69 ± 350.19	1343.75 ± 560.97	.035@
Total procedure time (minutes) (mean ± SD)	33.88 ± 7.72	46.25 ± 12.15	.002@
Total follow up after bone biopsy (months) (mean ± SD)	12.31 ± 7.79	11.5 ± 6.96	.758@

SD = Standard deviation; IQR = Interquartile range; CTDIvol = CT dose index volume; DLP = Dose length product
@ = Independent samples t-test
$ = Mann-Whitney U test
# = Fisher's Exact test

Conclusions:

CT-guided percutaneous bone biopsy using the On-Control battery powered bone access system is a safe, quick, and effective method.