Lytic vs Sclerotic Bone Lesions: Diagnostic Accuracy of CT-guided CORE vs FNA Biopsy Techniques

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Histological diagnosis pivotal in the workup and treatment of bone lesions

Confirmed histopathological diagnosis necessary to direct the treatment plan

Open surgical biopsy the gold standard

- Invasive
- Significant seeding of tumor to surrounding tissues
- Difficult in deep pelvic or vertebral lesions
Background

- Imaging-guided percutaneous needle biopsy
  - Lower expenses
  - Less invasive
  - Fewer complications
- Types
  - Core needle biopsy (CORE)
  - Fine Needle Aspiration (FNA)
Background

- Conflicting data concerning its diagnostic yield in both lytic and sclerotic lesions, ranging from 69% to 87.4%
- No study comparing CORE to FNA diagnostic yield on the same lesion
Test the diagnostic yield of CORE versus FNA biopsy in bone tumors
Relate it to
- Lesion type
- Size
- Location
- Pathology
Methods

- Retrospective chart review of patients that had a CT guided CORE and/or FNA biopsy of bone performed at our institution from January 2013 to June 2014
- >70% sclerotic, considered a sclerotic lesion
- >70% lytic, classified as lytic
- Exclusion
  - Mixed lesions
  - Infections
Lytic lesion in the Rt ileum
Sclerotic lesion
Right Acetabulum
Methods

- Electronic medical records reviewed for:
  - diagnostic yield
  - primary tumor
  - final surgical or pathological diagnosis
- Respective CT scans analyzed for:
  - maximal lesion size in anteroposterior dimension
  - lesion type
  - skeletal location
  - type of needles used
- Repeat biopsies disregarded and their initial biopsy was considered
Methods

- Diagnostic biopsy defined as presence of adequate sample to
  - Propose a specific diagnosis
  - Deny the presence of neoplasia
- Non-diagnostic, reference neoplasia status
  - Open surgical biopsy
  - Subsequent repeat biopsy were
Methods

- CORE performed on 102 subjects
- FNA done on 76
- 64 subjects both CORE and FNA done
- 38 had CORE alone and 12 had FNA alone
Methods

- Diagnostic yield calculated for
  - CORE and FNA in common population of 64
  - CORE in all lesions were it was performed (total of 102)
  - FNA in all lesions were it was performed (total of 76)
  - Overall, CORE and/or FNA

- Subgroup analysis compared diagnostic yields of CORE versus FNA in lytic and sclerotic lesions in the common population

- Compared the diagnostic yield for CORE in neoplastic versus non-neoplastic lesions

- Similar comparisons were done for FNA
Methods

Assessed if the type of lesion, skeletal location or gender affects overall diagnostic yield
Pearson chi-square test or Fisher’s exact test for statistical analysis
Binary logistic regression model predicted the diagnostic yield from the combined effects of age, gender, final diagnosis, CORE or FNA used, and lesion size, type and location
Results

- 114 subjects
  - 51 females (mean age 61 years ±13.75, range 27-86)
  - 63 males (mean age 60.4 years ±13, range 19-82)
- Lesions
  - 23mm ±15 average size, range 3-71mm
  - 83 (72.8%) lytic vs 31 (27.2%) sclerotic lesions
  - 89 (78.1%) of the biopsied specimens were neoplastic
- Overall diagnostic yield 81.6%
  - 83.1% success rate for lytic lesions
  - 77.4% for sclerotic, p=0.48
Results

Diagnostic yield

- CORE 79.4% (where it was performed, 81 out of 102)
- FNA 43.4% (where it was performed, 33 out of 76)

In cases where both were done

- CORE was diagnostic in 81.3% (52 out of 64)
- FNA at 32.8% (21 out of 64), p-value 0.084

Subgroup analysis

- CORE and FNA similar yield in lytic lesions
- No FNA diagnostic as opposed to 71.4% for CORE (5 out of 7) in sclerotic
Results

- Overall diagnostic yield
  - Not affected by the location of the lesion
  - Significantly different between genders, p-value of 0.033
    - Females 90.2% diagnostic
    - Males 74.6% diagnostic
  - 76.2% of non-diagnostic specimens were male
  - Diagnostic biopsies equally distributed between both genders (49.5% vs 50.5%)
Results

Lesion Nature, p-value=0.01
- 86.5% overall diagnostic yield in neoplastic lesions
  - CORE and FNA similar, p=0.23
- 64% in benign ones
  - Unable to compare CORE vs FNA as none of the FNA biopsies were diagnostic

CORE diagnostic yield, p=0.025
- 85% in neoplastic
- 63.6% in benign

FNA diagnostic yield, p=0.001
- 90.5% in neoplastic
- 53.8% in benign
Results

- Statistical model
  - Predictive of diagnostic yield
    - Gender, p=0.049
    - Neoplastic nature, p=0.018
  - Not predictive
    - Age
    - Lesion type
    - Skeletal location
    - Lesion size
    - CORE done or FNA done
Discussion

- Overall diagnostic yield of 81.6% within the range reported in literature.
- Diagnostic yield for CORE biopsies 79%, almost midrange of other studies (71% to 87.5%)\(^1-4\)
- Few studies focused on FNA results.
  - Hau\(^5\) reported 63% diagnostic yield, well above our success rate of 43.4%.
  - Number reported corresponds to all musculoskeletal lesions and not restricted to bone.

Considerably higher diagnostic yield for CORE biopsy as compared to FNA but statistically not significant

- CORE and FNA biopsies have similar yields in lytic lesions

- No diagnostic FNA biopsies in sclerotic
  - Lesions had lytic component of possible diagnostic value
Discussion

Eliminating confounders

Gender role

- Females with better yield, also evidenced by Kattapuram
  - Small sample size, p=0.049
  - Larger sample would render insignificant

Neoplasia

- 22.5% improvement in overall success rates over benign lesions, p=0.01
- CORE 21.4% better yield for neoplastic lesions, p=0.025
- FNA 36.7% better yield for neoplastic lesions, p=0.001

Sufficient evidence from our study and numerous others proving the nature of the lesion largely determines a successful biopsy

References

Discussion

No effect of lesion type on diagnostic yield
- 83.1% lytic compared to 77.4% sclerotic, $p=0.48$
- Wu et al: 87% lytic compared to 57% sclerotic, $p=0.002^1$
- Li’s et al: 90% lytic compared to 48.5% sclerotic, $p<0.001^2$

No effect for lesion location on diagnostic yield
- 78.9% appendicular compared to 84.2% axial, $p>0.4$
- Omura et al: confirmed our results, with 70% success rate vs 75% and $p=0.36^3$

Discussion

On-site immediate cytological assessment

- Virayavanich et al: success rates improved by 14%\(^1\)
- Tsou et al: improved yield by 3.8% for lung and 9.5% for nonpulmonary lesions\(^2\)

Goal of on-site assessment

- Not to provide a diagnosis
- Inform the radiologist of adequacy of specimen retrieval

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Weakness

- Retrospective study
- Only one of our FNA biopsies was diagnostic while CORE was not
- No sclerotic FNA biopsies were diagnostic
- No FNA was diagnostic in benign lesions
  - Unable to compare the yield of CORE to FNA in non-neoplastic lesions
Conclusion

First study to compare diagnostic yield of CORE to FNA biopsies when both were performed on the same lesion
48.5% better yield with CORE than FNA however we observed only a nearly significant p-value
Neoplastic lesions with better yield with either modality than benign ones, corroborating previous literature
Recommendations

- Immediate on-site cytological assessment
  - If available
    - FNA should be attempted first
    - Checked for the adequacy of tissue retrieval
  - If unavailable
    - Proceed directly with CORE biopsy due to its proven precision in providing an adequate tissue sample
References