Frameless stereotactic CT-guided needle brain biopsy in dogs

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Objectives

1. Design an inexpensive and reusable device
2. Developing a technique to simplify CT-guided brain biopsy in dogs
Device components

Flexible arm: part of brain retractor

Biopsy needle holder

Frame
Device components

clamps
Biopsy needle

- ø2.1 mm Sedan Side-Cutting
Technique

- 5 cadavers – beagles
- **Artificial forebrain lesion**
  - Mini-burr hole – opposite parietal bone
  - Spinal needle 22G 3½ inch
  - 0.4 ml
    - 0.2 ml methylene blue
    - 0.2 ml Hypaque-76
- **CT 3rd generation, GE**
  - Soft-bone tissue window
  - 3-mm-thick sections
- **Effectiveness**
  - Macroscopic examination collected samples
    - Blue color confirmed that the target area was collected
Technique

CT guided biopsy
intrathoracic lesion

- Tidwell et al. 1994 refer...

Clinical cases

- 4 dogs
- MRI: Forebrain lesion
Technique

1. Head fixed in a stable position
   (tape, Vac-loc positioning mattress)

2. Target area localized on one transverse contrast CT image

3. Table position noted
4. Skin marked with black permanent marker corresponding to the gantry laser light at this position

5. Several barium marks applied at 90° along the ink line
Technique

6. **New scan with table set at the previous noted position**
   - Lesion in the brain + barium lines over skin

7. **Barium line best aligned with the intracranial lesion**
   - Reference point
8. Sterile scrub
9. Skin incision
10. Underlying muscles incision and dissection from the calvarium
11. 2 Gelpi retractors to maintain muscles retraction
12. **Craniotomy**: hand drill; ø3 mm bit
Technique

Mini-burr hole
12. **Craniotomy enlargement**: 1 mm Kerrison Rongeur
13. Apparatus holding the biopsy needle mounted over the patient head

14. Tip of the needle faced in the craniotomy

15. Needle alignment to the transverse plan and to the lesion by using
   - CT gantry laser light
16. **Table re-positioned at the same previous chosen target area**

17. **Final adjustment**
   A) Oblique plan pointed to the lesion
   
   B) + Serial transverse CT scans
18. **Distance**
   from the tip of the needle
to the center of the lesion

18. **Needle advancement**

19. **CT scan** to assure needle
position within the lesion
20. **Negative pressure** with 10 ml syringe

21. **Inner biopsy needle**
   - rotated to 180°
   - removed
   - flushed w/ air and sterile saline

22. **3 samples**
   - distal, center, proximal
     - Cytology,
     - Histopathol
     - Bacteriol
Technique

- Duration 2.5-3 hrs
  - Including cytology time
- No complication
- Discharged after 48 hrs
Results

- Pathologic samples in all 4 dogs

- Diagnostic in 3 dogs
  - GME, Astrocytoma, Choroid plexus papilloma
  - In 2 dogs confirmed on necropsy
Discussion

Advantages

- No need for calculation of X,Y,Z axis coordinates
  - Direct visualization of needle tip relative to the target in the same CT image
- Errors in target trajectory can be adjusted as needed
- Reusable

Disadvantages

- Limited to forebrain lesions
Conclusions

- Effective
- Relatively simple
- Valid alternative to other techniques
- May be improved
- Further investigated in larger number of cases
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