

Unenhanced Attenuation and Histogram Analysis in CT Diagnosis of Adrenal Tumors

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Poster presentation

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UNENHANCED ATTENUATION AND HISTOGRAM ANALYSIS IN CT DIAGNOSIS OF ADRENAL TUMORS
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1. PURPOSE

Unenhanced axial CT scans are a readily obtainable imaging modality for adrenal gland. It is suitable for detecting benign adenomas from malignant lesions including pheochromocytoma, paraganglioma and pheochromocytoma. Our aim was to verify the optimal cut-off value for unenhanced CT attenuation and the utility of histogram analysis in the CT imaging of adrenal adenomas and pheochromocytoma.

2. Materials and Methods

We retrospectively analyzed CT data of patients who underwent adrenal mass CT scan (3000-3500 in total). 100 adenomas were pathologically confirmed. Unenhanced CT scan was not available in 120 out of 300 subjects. Furthermore, we excluded 9 pheochromocytoma, 9 paraganglioma and 20 benign lesions from 300. In total, 260 lesions were included in the analysis. Mean of attenuation and number of negative pixels was measured in each lesion. The results were compared with the Final histology. Sensitivity, specificity, PPV and positive predictive value (PPV) were calculated from the cut-off value of unenhanced attenuation (HU) and HU SD for a range of 10% and 5% of negative pixels.

3. Results

Our study group included 123 adenomas, 19 pheochromocytoma, 49 paraganglioma, 37 pheochromocytoma, 20 paraganglioma.

When unenhanced attenuation with a cut-off value 22 HU resulted in 92.8% Sp, 92.8% and PPV 98.7% for benign adenoma and 100% for pheochromocytoma. Mean and standard deviation of cut-off value 22 HU resulted in 73.2% Sp, 92.2% and PPV 98.2%. For the histogram with a cut-off value 20% resp. 25% negative pixels (standard 21.5% resp. 22.4%), Sp CT HU resp. 76.4% and PPV 92.1% resp. 92.4%.

4. Conclusions

Unenhanced attenuation with a cut-off value of 22 HU is the easiest and the most specific method for detecting benign adenomas with paraganglioma from other types of adrenal tumors. For lesions with an enhanced attenuation >22 HU, it is appropriate to perform more detailed histogram analysis with the cut-off value of 20% of negative pixels.

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Introduction

- **Incidentalomas** of the adrenal gland are a relatively common finding
- First of all it is necessary to **differentiate benign lesions** (most common adenomas, myelolipomas) **from** so-called **non-adenomas** (including metastases, pheochromocytomas and carcinomas)
- Our aim was to **verify the optimal cut-off value for unenhanced CT attenuation and the number of negative pixels in the CT histogram** of adrenal adenomas and non-adenomas.

Method

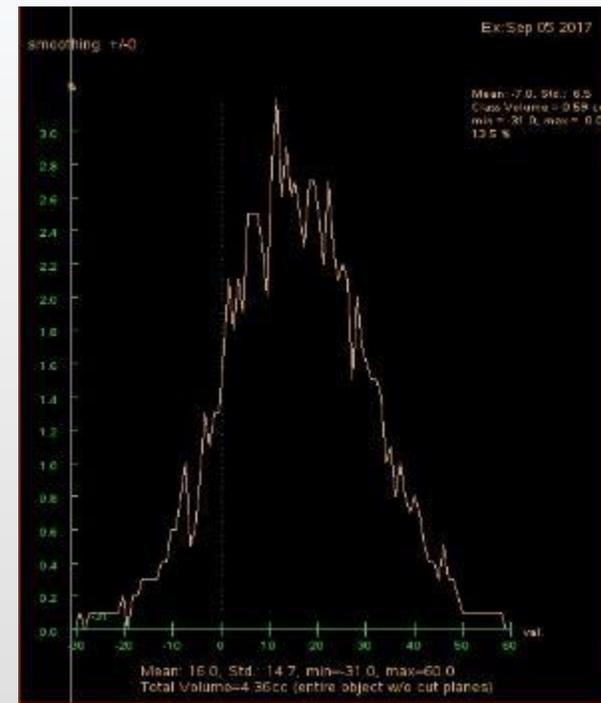
- We retrospectively analyzed CT data of patients who underwent adrenalectomy in period 2002-2017 (in total, 392 adrenalectomies were performed)
- We excluded: - 136 patients, whose preoperative unenhanced CT was not available (MRI, PET/CT),
 - 8 hematomas,
 - 8 purely cystic lesions,
 - 35 lesions smaller than 10 mm.
- **205 tumors were left for the analysis** – we measured: - **mean unenhanced attenuation**
- **percentage of negative pixels**
- **Sensitivity (Se), specificity (Sp) and positive predictive value (PPV)** was calculated for cut-off values of unenhanced attenuation 10 HU and 15 HU and for a histogram value of 10% and 5% of negative pixels.

Method

- We analysed 205 lesions and results compared with final histology

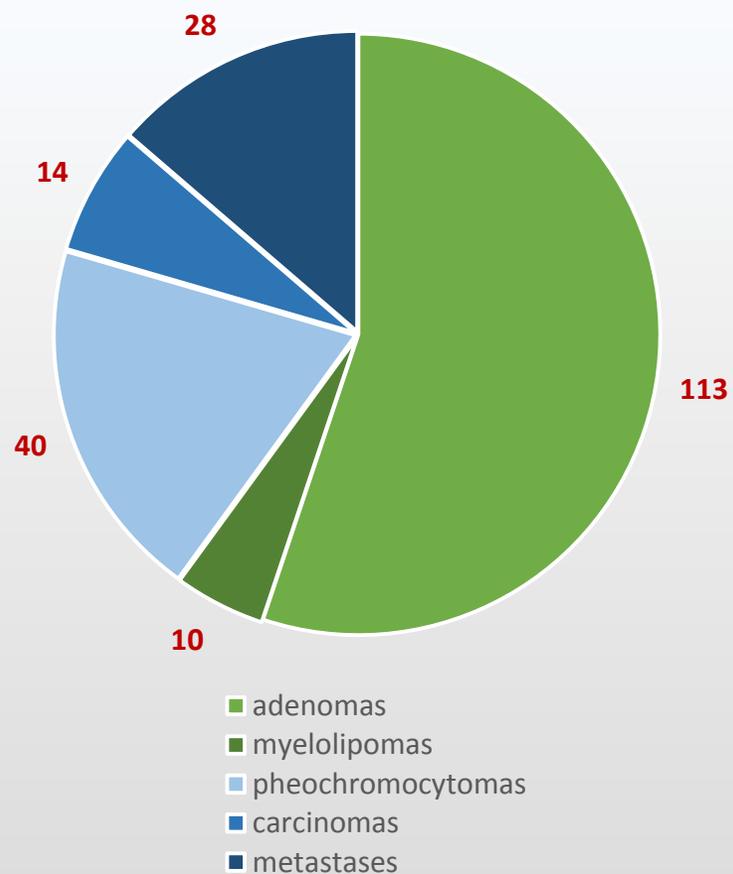


Lesion of adrenal gland:
- mean unenhanced
attenuation was 16 HU
- 13,5 % of pixels in selected
ROI with attenuation lower
than 0 HU – corresponding to
a lipid-poor adenoma, which
was later histologically
confirmed.

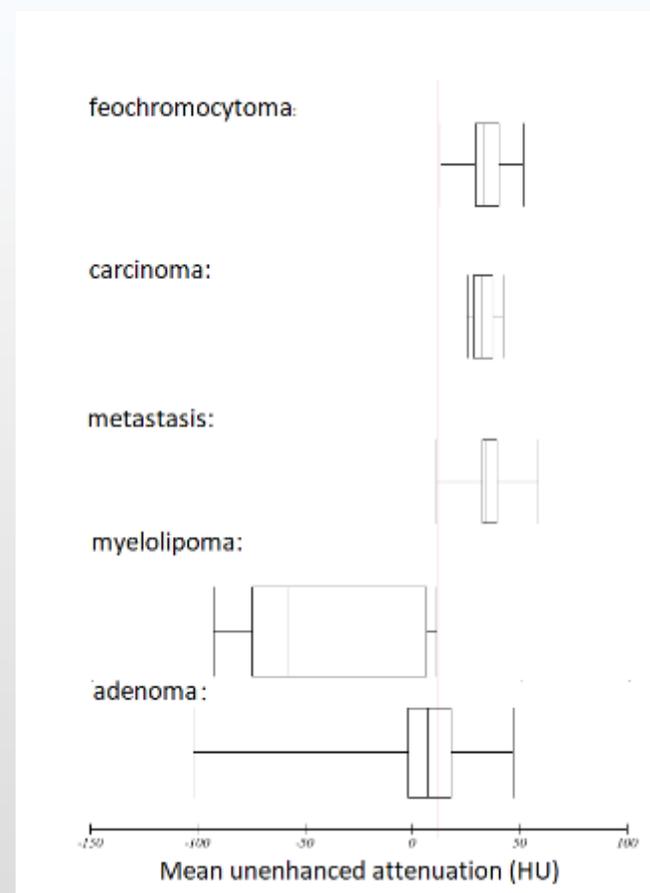


Results

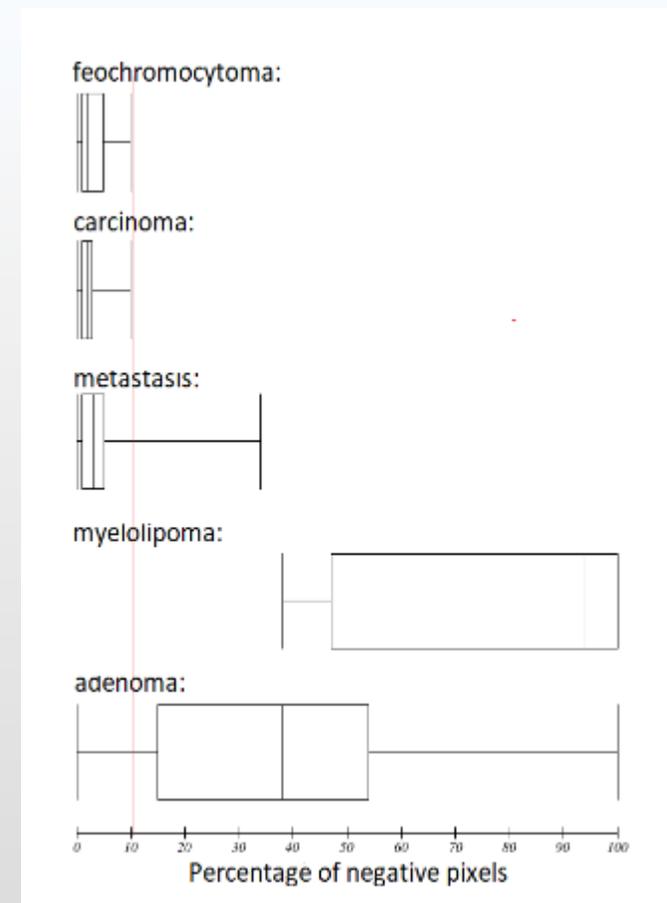
Histology



Box-plot 1: mean attenuation of different adrenal lesions:



Box-plot 2: percentage of negative pixels of adrenal lesions:



Results and Conclusion

Which cut-off value is optimal?

Mean unenhanced attenuation:	Sensitivity:	Specificity:	PPV:
10 HU	62,6 %	98,8 %	98,7 %
15 HU	71,5 %	96,3 %	69,3 %
Cut-off value of negative pixels:	Sensitivity:	Specificity:	PPV:
10 %	84,8 %	97,6 %	98,1 %
5 %	88,6 %	75,6 %	84,5 %

Conclusion:

- Unenhanced attenuation with cut-off value of **10 HU is the simplest and the most specific method** for differentiating benign adenomas and myelolipomas from other types of adrenal tumors.
- **For lesions with unenhanced attenuation >10 HU**, it is appropriate to perform more time-consuming **histogram analysis with the cut-off value of 10% of negative pixels.**

Thank you for your attention



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1. Purpose

Incidentalomas of the adrenal gland are a relatively common incidental finding. In clinical practice, it is crucial to distinguish benign adenomas from so-called non-adenomas, including metastases, pheochromocytomas and carcinomas. Our aim was to verify the optimal cut-off value for unenhanced CT attenuation and the number of negative pixels in the CT histogram of adrenal adenomas and non-adenomas.

2. Materials and Methods

We retrospectively analyzed CT data of patients who underwent adrenalectomy in period 2002-2017. In total, 392 adrenalectomies were performed. Preoperative unenhanced CT was not available in 136 out of 392 subjects; furthermore, we excluded 8 hematomas, 8 purely cystic lesions and 35 lesions smaller than 10 mm. Thus, 205 tumors were left for the analysis. Mean attenuation and number of negative pixels was measured in each lesion. The results were compared with the final histology. Sensitivity (Se), specificity (Sp) and positive predictive value (PPV) was calculated for cut-off values of unenhanced attenuation 10 HU and 15 HU and for a histogram value of 10% and 5% of negative pixels.

3. Results

Our study group included 113 adenomas, 10 myelolipomas, 40 pheochromocytomas, 14 carcinomas, 28 metastases.

Mean unenhanced attenuation with cut-off value 10 HU reached Se 62.6%, Sp 98.8% and PPV 98.7% for benign adenomas and myelolipomas. Mean unenhanced attenuation with cut-off value 15 HU reached Se 71.5%, Sp 96.3% and PPV 69.3%.

For the histogram with cut-off value 10% resp. 5% negative pixels Se reached 84.8% resp. 88.6%, Sp 97.6% resp. 75.6% and PPV 98.1% resp. 84.5%.

Chart – results:

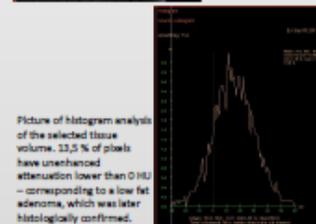
Mean unenhanced attenuation:	Sensitivity:	Specificity:	PPV:
10 HU	62,6 %	98,8 %	98,7 %
15 HU	71,5 %	96,3 %	69,3 %

Cut-off value of negative pixels:	Sensitivity:	Specificity:	PPV:
10 %	84,8 %	97,6 %	98,1 %
5 %	88,6 %	75,6 %	84,5 %

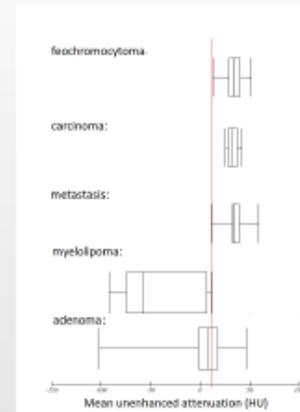
Images of histogram analysis:



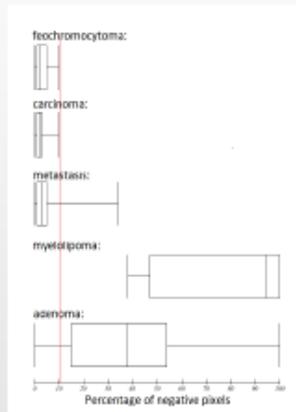
First image is cut from CT image – it depicts the ROI in the left adrenal gland for attenuation measurements. In this case the mean unenhanced attenuation was 16 HU.



Box-plot 1: mean unenhanced attenuation of different adrenal lesions:



Box-plot 2: percentage of negative pixels of adrenal lesions:



4. Conclusion

Unenhanced attenuation with a cut-off value of 10 HU is the simplest and the most specific method for differentiating benign adenomas and myelolipomas from other types of adrenal tumors. For lesions with unenhanced attenuation >10 HU, it is appropriate to perform more time-consuming histogram analysis with the cut-off value of 10% of negative pixels.