DISCRIMINATORY VALUE OF CLINICAL FEATURES IN CUSHING’S SYNDROME: WHAT HAS CHANGED?

Alltogether to Beat Cushing’s Syndrome
Naples 5th-7th of May, 2015

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Medizinische Klinik und Poliklinik IV
Ludwig-Maximilians-Universität München
Cushing’s syndrome: Where is the science going on? PubMed listed publication (1900-2015)

- US: 977
- UK: 411
- Spain: 137
- France: 289
- Italy: 518
- Holland: 213
- Germany: 240
- Japan: 589
Overview: Cushing

- Introduction
  - German Cushing Registry
  - Automatic Face Recognition
  - Results of the ‘Diagnostic Study’
- Conclusions
Cushing disease: a Rare Condition

0.7–2.4 new cases per million each year
Spain, Italy, Denmark

55 people per million
Belgium

60 people per million
New Zealand

1,4 new cases per million each year, Bulgaria

## Cushing syndrome in Diabetes and Obesity

<table>
<thead>
<tr>
<th>Author</th>
<th>Disease</th>
<th>N</th>
<th>N (%) Screening</th>
<th>N (%) confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leibowitz et al. 1996</td>
<td>DM, HbA1c &gt; 9; Obesity</td>
<td>90</td>
<td>4 (4.4%)</td>
<td>3 (3.3%)</td>
</tr>
<tr>
<td>Catargi et al. 2003</td>
<td>DM, HbAa1c &gt; 8; Obesity</td>
<td>200</td>
<td>52 (26%)</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Caetano et al. 2007</td>
<td>DM2, overweight</td>
<td>103</td>
<td>8 (7.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Reimondo et al. 2007</td>
<td>New DM2</td>
<td>100</td>
<td>5 (5%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Newton et al. 2008</td>
<td>DM2</td>
<td>171</td>
<td>32 (18.7%)</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Mullan et al. 2010</td>
<td>DM2, HBA1c &gt; 7, BMI &gt; 25</td>
<td>201</td>
<td>47 (23%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Baid et al. 2009</td>
<td>Overweight, obesity</td>
<td>369</td>
<td>n.a.</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Fierabracci et al. 2010</td>
<td>Morbid obesity</td>
<td>783</td>
<td>n.a.</td>
<td>6 (0.8%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2017</td>
<td>148 (17.1%)</td>
<td>15 (0.7%)</td>
</tr>
</tbody>
</table>
Cushing’s syndrome: S&S in textbooks

<table>
<thead>
<tr>
<th>Unspecific/low discriminatory value</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>40–80</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>25–50</td>
</tr>
<tr>
<td>Hirsutism</td>
<td>30–50</td>
</tr>
<tr>
<td>Hypertension</td>
<td>50</td>
</tr>
<tr>
<td>Osteoporotic fracture</td>
<td>40–50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific/high discriminatory value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin changes (atrophy, rubeosis, plethora, ecchymosis, wide violaceous striae, acne, skin infections)</td>
<td>100</td>
</tr>
<tr>
<td>Truncal obesity</td>
<td>80–100</td>
</tr>
<tr>
<td>Moon face</td>
<td>50–95</td>
</tr>
<tr>
<td>Myopathy</td>
<td>30–90</td>
</tr>
<tr>
<td>Oligomenorrhea/impotence</td>
<td>30–85</td>
</tr>
<tr>
<td>Mental disturbances</td>
<td>50–80</td>
</tr>
</tbody>
</table>
The median time elapsed between onset of symptoms and final diagnosis was 2.0 yrs. (range < 1 month to 15.7 yrs.). In male patients it was 1.6 yrs. (range < 1 month to 15.2 yrs.), in female 2.0 yrs. (range < 1 month to 15.2 yrs.). About 20% of patients were diagnosed after more than 5 years (CD 61%; AC 33%; EC 6%).
### Discriminatory value of signs and symptoms of Cushing syndrome
the past, the presence and the future

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>73</td>
<td>481</td>
<td></td>
</tr>
<tr>
<td>Osteopenia</td>
<td>na</td>
<td>5.6</td>
<td>-</td>
</tr>
<tr>
<td>Recurrent infections</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Red striae</td>
<td>2.8</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Amenorrhea</td>
<td>2.7</td>
<td>2.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Abdominal fat distribution</td>
<td>2.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Plethora</td>
<td>2.5</td>
<td>-</td>
<td>3.0</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>2.4</td>
<td>3.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Hirsutism</td>
<td>2.1</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.6</td>
<td>1.9</td>
<td>-</td>
</tr>
<tr>
<td>Loss of libido</td>
<td>1.4</td>
<td>1.1</td>
<td>-</td>
</tr>
<tr>
<td>Oedema</td>
<td>1.0</td>
<td>-</td>
<td>2.9</td>
</tr>
<tr>
<td>Depression</td>
<td>0.9</td>
<td>0.6</td>
<td>-</td>
</tr>
</tbody>
</table>
Overview: Cushing

- Introduction
- German Cushing Registry
- Automatic Face Recognition
- Results of the ‘Diagnostic Study’
- Conclusions
### Why start a Cushing Registry in 2012?

<table>
<thead>
<tr>
<th></th>
<th>Pheo</th>
<th>Primary Aldo.</th>
<th>Cushing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare Disease?</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Sufficient screening test?</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subtype testing accuracy?</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Overall diagnostic accuracy?</td>
<td>++</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Excellent surgical outcome?</td>
<td>+</td>
<td>+</td>
<td>(+)</td>
</tr>
<tr>
<td>Pathophysiology elucidated?</td>
<td>++</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td>Medical treatment</td>
<td>(+)</td>
<td>++</td>
<td>(+)</td>
</tr>
</tbody>
</table>
Goals of a Cushing’s Registry

- To build a cohort of sufficient epidemiologic strength for studies of high evidence
- To investigate long-term morbidity and mortality
- To identify patients with high risk for adverse events
- To identify those factors that contribute to persistence of Cushing associated co-morbidities despite biochemical cure
- To define better diagnostic tests for Cushing syndrome
- To build a network for IIT in the treatment of CS
### Power Calculation

#### Case-control study, 1:2 matching, significance $\alpha = 0.05$

<table>
<thead>
<tr>
<th>Odds ratio</th>
<th>250</th>
<th>300</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>0.065</td>
<td>0.068</td>
<td>0.079</td>
<td>0.095</td>
<td>0.109</td>
<td>0.14</td>
</tr>
<tr>
<td>1.3</td>
<td>0.164</td>
<td>0.188</td>
<td>0.282</td>
<td>0.394</td>
<td>0.497</td>
<td>0.667</td>
</tr>
<tr>
<td>1.5</td>
<td>0.323</td>
<td>0.376</td>
<td>0.565</td>
<td>0.739</td>
<td>0.851</td>
<td>0.957</td>
</tr>
<tr>
<td>1.7</td>
<td>0.498</td>
<td>0.572</td>
<td>0.789</td>
<td>0.923</td>
<td>0.974</td>
<td>0.998</td>
</tr>
<tr>
<td>1.9</td>
<td>0.652</td>
<td>0.731</td>
<td>0.914</td>
<td>0.983</td>
<td>0.997</td>
<td>1</td>
</tr>
<tr>
<td>2.1</td>
<td>0.771</td>
<td>0.841</td>
<td>0.969</td>
<td>0.997</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.3</td>
<td>0.854</td>
<td>0.910</td>
<td>0.989</td>
<td>0.999</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.5</td>
<td>0.909</td>
<td>0.950</td>
<td>0.997</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.7</td>
<td>0.944</td>
<td>0.973</td>
<td>0.999</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Diagnosis: Cushing’s Syndrome
determination of subtypes
specific therapy

Standardised follow-up examination
(requested: V1-V3 month 0, 6, 12, 24)

Initial diagnosis
Follow-up after 6 month
Follow-up after 12 month
Follow-up after 24 month
Follow-up after 72 month
Deutsches Cushing Register

Retrospective data entry (Cohort 1: >400)

Clinical, biochemical, metabolic and cardiovascular characterization of retrospective patients invited to (annual) follow up (Cohort 2: 140)

Prospective recruitment of newly diagnosed patients with CS (Cohort 3: 65)

Intervention trials
Participating centers:

- Ziemssenstraße, MK IV, München
- MPI f. Psychiatrie, München
- Uni Düsseldorf
- Uni Dresden
- Uni Würzburg
- Uni Tübingen
- Uni Essen
- Uni Erlangen
- Berlin (Praxis Quinkler)
- Berlin (Endokrinologikum)
End points of the cohort study:

Hypothesis-driven data base:

- cardiovascular morbidity
- metabolic comorbidity
- psychiatric comorbidity
- musculoskeletal comorbidity

Standardized follow-up examination of CS patients:

- Medical history and clinical examination
- Quality of life questionnaires
- Measurements (blood pressure, muscle power, grip strength, ECG, bioelectrical impedance, thyroid ultrasound, intima-media thickness, BMD)
- Laboratory findings, biomaterial deposition (plasma, tumor, saliva, urine, hair)
Deutsches Cushing Register

- **Diagnosis of CS**
  - Schneider et al. Clin Endo 2013
  - Schneider et al. ECED 2013
  - Johar et al. JCEM 2014

- **Surgical Outcome**
  - Dimopoulou et al. EJE 2013
  - Ritzel et al. JCEM 2013
  - Osswald et al. EJE 2014
  - Di Dalmazi et al. JCEM 2014
  - Berr et al., JCEM 2015

- **Subtype differentiation**
  - Ritzel et al. EJE 2015
  - Di Dalmazi et al. 2014

- **Genetics of CS**
  - Beuschlein et al. NEJM 2014
  - Di Dalmazi et al. JCEM 2014
  - Reincke et al. Nat Gen 2015
  - Perez-Rivas et al., JCEM 2015

- **CNS:** Anxiety, depression, impaired quality of life

- **Cardiovascular co-morbidities:**
  - MI, heart failure, stroke, AF

- **Metabolic co-morbidities:**
  - glucose intolerance, lipid abnormalities,

- **Musculoskeletal co-morbidities**
  - Osteoporosis, sarcopenia
Overview: Cushing

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Screening with for endocrine diseases with face classification: the experience with acromegaly

- Initial study
- Subjects:
  - N=57 acromegalic, N=60 age- and sex-matched controls
- Frontal and side photographs with digital camera
- Face classification based on
  - Texture (Gabor wavelets)
  - Geometry of landmarks
- Calculation of correct classification rate using the leave-on-out method
### Results

<table>
<thead>
<tr>
<th>correct classification rates (%)</th>
<th>Software(^1)</th>
<th>Experts(^2)</th>
<th>Internists(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>81.9</td>
<td>72.1</td>
<td>64.9</td>
</tr>
<tr>
<td>Acromegaly</td>
<td>71.9</td>
<td>63.2</td>
<td>42.1</td>
</tr>
<tr>
<td>Controls</td>
<td>91.5</td>
<td>80.8</td>
<td>87.0</td>
</tr>
</tbody>
</table>

Schneider et al. JCEM 2011
Proof-of-principle study in women with Cushing‘s syndrome

● Subjects:
  ● N=20 women with Cushing‘s syndrome
  ● N=40 age- and sex-matched controls

● frontal and side photographs with digital camera
● Face classification based on
  – Texture (Gabor wavelets)
  – Geometry of landmarks
● Calculation of correct classification rate using the leave-one-out method
### Results

<table>
<thead>
<tr>
<th>Classification Accuracy (%)</th>
<th>n</th>
<th>FIDA(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>60</td>
<td>91.7</td>
</tr>
<tr>
<td>Patients / Sensitivity</td>
<td>20</td>
<td>85.0</td>
</tr>
<tr>
<td>Endogenous CS</td>
<td>12</td>
<td>75.0</td>
</tr>
<tr>
<td>- Central CS</td>
<td>8</td>
<td>62.5</td>
</tr>
<tr>
<td>- Adrenal CS</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>Iatrogenic CS</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>Controls / Specificity</td>
<td>40</td>
<td>95.0</td>
</tr>
</tbody>
</table>

\(^a\) Schneider et al., JCEM (2011)
Schneider et al., ECED(2013)
Ongoing prospective study on Cushing‘s syndrome

Recruitment targets:

● 50 patients with Cushing‘s syndrome
● 100 age-, sex- and BMI-matched controls referred for exclusion of Cushing‘s syndrome
● Recording of clinical parameters, face classification and biochemical parameters

Aim:

● Determining classification rates with face classification and establishment of a Clinical Prediction Score for the presence of Cushing‘s syndrome
Preliminary results

- Included subjects
- 56 Patients (40 women, 16 men)
- 60 controls (30 women, 30 men)
Preliminary results

<table>
<thead>
<tr>
<th></th>
<th>Controls m N=30</th>
<th>Patients m N=16</th>
<th>Controls f N=30</th>
<th>Patients f N=40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI</strong></td>
<td>BMI</td>
<td>BMI</td>
<td>BMI</td>
<td>BMI</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>32.9</td>
<td>27.7</td>
<td>34.2</td>
<td>29.9</td>
</tr>
<tr>
<td><strong>p</strong></td>
<td>0.0045</td>
<td></td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td><strong>Age (y)</strong></td>
<td>43.5</td>
<td>53.5</td>
<td>43.4</td>
<td>55.5</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>p</strong></td>
<td>0.060</td>
<td></td>
<td>0.0008</td>
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</tbody>
</table>
### 1:1-matching by BMI: Preliminary results

<table>
<thead>
<tr>
<th>BMI-matched</th>
<th>Patients</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct classification rates (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women N=54</td>
<td>70.4</td>
<td>74.0</td>
</tr>
<tr>
<td>Men N=31</td>
<td>68.8</td>
<td>75.0</td>
</tr>
<tr>
<td>All patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct classification rates (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women N=70</td>
<td>72.5</td>
<td>53.3</td>
</tr>
<tr>
<td>Men N=46</td>
<td>43.8</td>
<td>90.0</td>
</tr>
</tbody>
</table>
Overview: Cushing

- Introduction
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- Automatic Face Recognition
- Results of the ‘Diagnostic Study’
- Conclusions
Problem: Single signs and symptoms do not have the desired discriminatory power

Question: is there the potential to develope a simple, diagnostic score with good predictive value?

Study: prospective, multicentric, standardized evaluation of all relevant parameters in a large cohort with adequate statistical power

(⇒ Diagnostikstudie)
Cushing syndrome - signs and symptoms

- Moon face
- Buffalo hump
- Central obesity
- Striae rubrae (>1 cm width, purple)
- Easy brusising, impaired wound healing
- Proximal myopathy
- Cognitive deficits, depression
- Arteriell hypertension
- Impaired glucose tolerance, metabolic syndrome,
  Hyperlipidemia
- Immunosuppression, osteoporosis
The German Cushing Registry *Diagnostic Study*: study outline

- Investigation of the prevalence of signs and symptoms of Cushing‘s syndrome *versus* rule-out Cushing cases.

150 patients referred for evaluation of Cushing‘s syndrome

- Standardized clinical and biochemical evaluation, histology or follow-up (3-12 months)

- Confirmed Cushing‘s syndrome \(N=50\)

- Definitive exclusion of Cushing‘s syndrome \(N=100\)
Total prospective cases in 4 German centers

Including subclinical cases, excluding cosecretory cases and unclassified cases
### Cushing patients by centers and entity

#### Cushing’s syndrome

<table>
<thead>
<tr>
<th>Centers</th>
<th>Total (2012-2015)</th>
<th>Cushing’s Disease</th>
<th>Adrenal Cushing’s syndrome</th>
<th>Ectopic Cushing’s</th>
<th>Rule-out Cushing’s syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>München 1 (LMU)</td>
<td>44</td>
<td>31</td>
<td>8</td>
<td>5</td>
<td>87</td>
</tr>
<tr>
<td>München 2 (MPI)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
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<tr>
<td>Würzburg</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>0</td>
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<tr>
<td>Dresden</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td>11</td>
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<tr>
<td>Düsseldorf</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Tübingen</td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>65</strong></td>
<td><strong>51</strong></td>
<td><strong>9</strong></td>
<td><strong>5</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Anmerkung: inkl. Subklinische Patienten, exklusive unklare Fälle, Cosekretion etc.
The German Cushing Registry Diagnostic Study: Interim Analysis

- Investigation of the prevalence of signs and symptoms of Cushing’s syndrome versus rule-out Cushing cases.

109 patients referred for evaluation of Cushing’s syndrome

Standardized clinical and biochemical evaluation, histology or follow-up (3-12 months)

Confirmed Cushing’s syndrome \( N=34 \)

Definitive exclusion of Cushing’s syndrome \( N=75 \)
Leading Symptoms

- **Weight gain**: 32.00%
- **Obesity**: 12.00%
- **Hypertension**: 22.00%
- **Cushing stigmata**: 9.00%
- **Hirsutism**: 5.00%
- **Laboratory abnormality**: 4.50%
- **Muscle weakness**: 3.50%
- **Depression/anxiety**: 5.00%
- **Osteoporosis**: 3.00%
- **Adrenal incidentaoma**: 22.00%
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Controll group</th>
<th>Cushing ‘s syndrome (total)</th>
<th>P value</th>
<th>Cushing ‘s disease</th>
<th>Adrenal Cushing ‘s syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>75</td>
<td>34</td>
<td></td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>sex (% female)</td>
<td>68 %</td>
<td>64 %</td>
<td></td>
<td>64 %</td>
<td>67 %</td>
</tr>
<tr>
<td>age (years)</td>
<td>43.3</td>
<td>45.6</td>
<td>0.32</td>
<td>44.1</td>
<td>46.8</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>32.6</td>
<td>30.4</td>
<td>0.22</td>
<td>30.1</td>
<td>29.8</td>
</tr>
<tr>
<td>Blood pressure sys</td>
<td>141</td>
<td>153</td>
<td>0.002*</td>
<td>151</td>
<td>152</td>
</tr>
<tr>
<td>Blood pressure dia</td>
<td>89</td>
<td>98</td>
<td>0.007*</td>
<td>96</td>
<td>99</td>
</tr>
<tr>
<td>Diabetes rate</td>
<td>12 %</td>
<td>38 %</td>
<td></td>
<td>32 %</td>
<td>50 %</td>
</tr>
</tbody>
</table>
Prevalence, patient's history
Sensitivity and specificity, patient‘s history
Positive predictive value, patient’s history

- Hypertension
- Sleep apnea
- Cerebrovascular Event
- Myocardial Infarction
- Smoker
- Diabetes mellitus
- Glucose intolerance
- Dyslipidemia
- Deep vein thrombosis
- Lung embolism
- Coagulopathy
- Nephrolithiasis
- Osteoporosis
- Depression
- Anxiety disorder
- Treatment for psychiatric disease
- Further psychiatric disease
- Ambul. infections
- Hospital infections
- Loss of libido
- Weight change

positive predictive value
Deutsches Cushing Register

Catabolism

Fat distribution

Cushing’s signs -prevalence-

- Easy bruising
- thin skin
- Striae
- Muscle weakness
- Hirsutism
- Moon face
- Plethora
- Buffalo hump
- Hair loss
- Acne
- Leg edema

controll group

Cushing's syndrome
Catabolism

Fat distribution

Cushing's signs

positive predictive value

- Easy bruising
- Thin skin
- Striae
- Muscle weakness
- Hirsutism
- Moon face
- Plethora
- Buffalo hump
- Hair loss
- Acne
- Leg edema
Subclinical Cushing’s syndrome (n=17)

Cushing’s signs

- Easy bruising
- Thin skin
- Striae
- Muscle weakness
- Hirsutism
- Moon face
- Pectsora
- Buffalo hump
- Hair loss
- Acne
- Leg edema
**Chair rising Test**

- Kontrollgruppe
- Cushing Syndrom

\[ p = 0.0052 \]

**Gripp strength**

- Kontrollgruppe linke Hand
- Kontrollgruppe rechte Hand
- Cushing Syndrom linke Hand
- Cushing Syndrom rechte Hand

\[ p = 0.044 \text{ (right)} \]
\[ P = 0.009 \text{ (left)} \]
German Cushing’s Registry
• Is an interesting tool to study prospectively clinical aspects of a rare disease

 Discriminatory value of S&S in Cushing’s
• Increasingly difficult in times of the ’obesity tsunami’

Automatic face recognition for Cushing’s syndrome
• Interim results disappointing

Diagnostic scoring system for Cushing’s syndrome
• Might be feasible!
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