Brain magnetic resonance imaging (MRI) overdetection & overtreatment

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Research to Understand Stroke due to Haemorrhage

The University of Edinburgh
NHS Lothian
What’s a brain incidentaloma?
How are brain incidentalomas detected?

**Diagnosis**

‘Monitoring’

**Research**

Screening ‘health checks’
I wanted the neurologist to tell me it was straightforward...

but when I said to him, "I'm a mother, I just can't die,"

he replied "God, you've got two kids - I'm surprised you survived childbirth."
£3,650

Ultimate Plus Check-Up

This specifically for key people who need continuous and thorough reassessment of current health and risk factors together with the highest level of reassurance and peace of mind. The Ultimate Plus Check-Up takes 6 hours and includes an X-ray film of the scans of your brain, heart, vascular system of colon (less invasive than a conventional colonoscopy), ultrasound examination of the thyroid, exercise test, over 40 blood tests and urine analysis, ECG, routine fasting and non-fasting blood sugar, consultations with Preventicum doctors including same day results consultation. MRI colonoscopy is recommended every 4 years below 50 years as one method of bowel cancer screening. A thorough assessment of current health and risk factors together with the highest level of reassurance and peace of mind.

- One-to-one consultation with a Preventicum doctor lasting approximately 40 minutes
- Detailed physical examination with a Preventicum doctor
- Vital observations including height, weight, BMI, resting heart rate, blood pressure
- Over 40 blood tests and urine analysis
- Hearing test
- Tonometry (Glaucoma/eye test)
- Resting and exercise ECG
- Spirometry (lung function test)
- Ultrasound examinations
- Magnetic Resonance Imaging (MRI) scans
- MRI colonoscopy
- Results consultation with a Preventicum Radiologist
- Same day results consultation with your Preventicum doctor.
EARLY DETECTION AND COMPLETE REMOVAL IS THE BEST KNOWN METHOD TODAY OF TREATING DEADLY TUMOR GROWTH.

Road to Early Detection is an initiative of The Brain Tumor Foundation aimed at broadening public awareness about brain tumors and the urgent need for preventative brain scans. With the introduction of this campaign, widespread early detection of brain tumors will be available to everyone.
Brain incidentalomas: fortuitous or futile?

Diagnosis

Research

Monitoring

Screening ‘health checks’
MRI incidentaloma frequency: meta-analysis

Condition | NNS
---|---
Other incidental findings | 50
Incidental brain findings (but not markers of cerebrovascular disease) | 37

*BMJ* 2009;339:b3016
## MRI incidentaloma frequency: meta-analysis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prevalence (%)</th>
<th>NNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arachnoid cyst</td>
<td>0.5</td>
<td>200</td>
</tr>
<tr>
<td>Aneurysm</td>
<td>0.35</td>
<td>286</td>
</tr>
<tr>
<td>Meningioma</td>
<td>0.3</td>
<td>345</td>
</tr>
<tr>
<td>Cavernous malformation</td>
<td>0.16</td>
<td>625</td>
</tr>
<tr>
<td>Arteriovenous malformation</td>
<td>0.05</td>
<td>2,000</td>
</tr>
<tr>
<td>Low grade glioma</td>
<td>0.05</td>
<td>2,000</td>
</tr>
</tbody>
</table>

*BMJ* 2009;339:b3016
A reservoir of ticking timebombs in the UK

<table>
<thead>
<tr>
<th></th>
<th>Prevalence</th>
<th>Incidence of bleeding /100,000/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aneurysm</td>
<td>2,051,200</td>
<td>5,833 (0.3%)</td>
</tr>
<tr>
<td>CCM</td>
<td>102,560</td>
<td>154 (0.2%)</td>
</tr>
<tr>
<td>AVM</td>
<td>32,050</td>
<td>327 (1%)</td>
</tr>
</tbody>
</table>

What’s worse, the treatment or the disease?

Aneurysm  

CCM  

AVM
Unruptured intracranial aneurysms

Untreated clinical course
- IPD meta-analysis
- Annual rupture risk = 1.4%

Treatment outcome
- Systematic review of endovascular coiling
- 1-month death/disability = 4.7%

One randomised controlled trial
- Trial of Endovascular Aneurysm Management (TEAM)
- Recruited 80 patients (of ~2,000 planned) 2006-2009

Risk of death/disability for unruptured aneurysm

Without treatment  After treatment

1 year

5 years
Cerebral cavernous malformations

Untreated clinical course
- Scottish population-based study
- Annual rupture risk = 0.5%

Treatment outcome
- Systematic review
- 1-month death/stroke
  - Supratentorial = 8%
  - Brainstem = 52%

No randomised controlled trials

Cerebral cavernous malformations

Outcome after surgery

Conservative management

Log rank (Mantel Cox), chi-square = 5.9, df=1, p=0.015

<table>
<thead>
<tr>
<th>Number at risk (events in previous year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>16(8)</td>
</tr>
<tr>
<td>15(0)</td>
</tr>
<tr>
<td>14(0)</td>
</tr>
<tr>
<td>14(0)</td>
</tr>
<tr>
<td>14(0)</td>
</tr>
<tr>
<td>Untreated</td>
</tr>
<tr>
<td>109</td>
</tr>
<tr>
<td>100(7)</td>
</tr>
<tr>
<td>95(4)</td>
</tr>
<tr>
<td>88(3)</td>
</tr>
<tr>
<td>87(1)</td>
</tr>
<tr>
<td>85(2)</td>
</tr>
</tbody>
</table>
Risk of death/stroke for CCM

Without treatment After treatment

1 year

5 years
Arteriovenous malformations

Untreated clinical course
- IPD meta-analysis
- Annual rupture risk = 1.3%

Treatment outcome
- Systematic review
- Annual risk of death/stroke = 7%

**RCT**
HR 0.27 (95% CI 0.14–0.54)

**Population-based cohort study**
adjusted HR 0.37 (95% CI 0.19–0.72)
Risk of death/stroke for unruptured AVM

Without treatment  

1 year

After treatment

5 years
Summary: incidentalomas on brain MRI

5-year rupture risk for most intracranial vascular incidentalomas: treated > untreated

~1% per year

~5 years
Management of Incidental Findings Detected During Research Imaging

Issued: September 2012

NICE clinical guideline 150
guidance.nice.org.uk/rg150

In collaboration with:
- MRC Medical Research Council
- NHS National Institute for Health Research Clinical Research Network
- National Patient Safety Agency
- National Research Ethics Service
- Royal College of Physicians
- Royal College of General Practitioners
- IPEM
- BIR
- MS Multiple Sclerosis Society

A report by Representatives of Research Imaging Centres, Professional Societies, Regulatory Bodies, Funding Organisations, Royal Colleges involved in research imaging and Patient Organisations, in the UK

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Full-Body Cardiovascular and Tumor MRI for Early Detection of Disease: Feasibility and Initial Experience in 298 Subjects

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OBJECTIVE. High diagnostic accuracy, emerging whole-body concepts, and lack of side effects combine to render MRI a natural candidate for screening purposes. The aim of this study was to evaluate the technical feasibility of a comprehensive multiorgan-targeting MRI examination and determine the frequency of findings in subjects without a history of serious disease.

SUBJECTS AND METHODS. The study group was composed of 331 subjects. The MRI protocol (mean examination time, 63 min) encompassed the target organs: the brain, arterial system, heart, and colon. Diagnoses were deemed relevant if the physician had to inform the subject about the findings. Subjects with a history of serious illnesses were excluded from subsequent analysis (n = 33). All analyses were performed for the resulting subgroup of 298 subjects (247 men, 51 women; mean age, 49.7 years).

CONCLUSION. The presented data point toward an increased use of MRI for screening in the future, but to date screening MRI should not be performed outside a research setting because the cost–benefit relation is unclear.
• RCTs of interventions
• Long-term balance?
• Detection prevention?
• Informed choice...
• Shared decisions...