Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Captopril renography, Doppler, the captopril test and arteriography.

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population was a hypothetical cohort of patients affected by renovascular hypertension and renal artery stenosis.

Setting
Hospital. The economic study was carried out in the USA.

Dates to which data relate
Effectiveness data was collected over the period 1983 to 1993. Mainly, 1993 resource data were used.

Source of effectiveness data
Published literature.

Outcomes assessed in the review
Outcomes were: sensitivity, specificity, positive predictive value.

Study designs and other criteria for inclusion in the review
Unspecified articles directed at screening procedures for renovascular hypertension and renal artery stenosis. The search was limited to English language articles published during 1983-1993. Additional articles were identified from the references of these reports. Criteria for inclusion in the final analysis were:

1. Data were reported during the last five years (1983-1993),
2. Studies had angiographic corroboration of results,
3. Patients included in more than one report were analysed only once,
4. No multi-centre studies were found with uniform protocols and were, therefore, not included.
(5) No renal transplantation studies were included,

(6) To represent a clinically screened general population, no studies with patients selected solely for fibromuscular disease or atherosclerotic disease were included, and

(7) True-positive, true-negative, false-positive or false-negative rates must have been calculable from the data presented.

Captopril renography was treated as two separate studies if two separate agents were used so that separate true-positive, true-negative, false-positive and false-negative could be calculated. Angioplasty and surgical repair data were treated as separate data sets even if they were combined in a single report.

Sources searched to identify primary studies
A MEDLINE literature search for articles directed at screening procedures for renovascular hypertension and renal artery stenosis was performed.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
47 articles were included. Study populations varied for each diagnostic test:

(1) captopril renogram (for renal artery stenosis), 10 studies, n=712;

(2) captopril renogram (for renovascular hypertension), 5 studies, n=256;

(3) Captopril test, 6 studies, n=656;

(4) Doppler, 7 studies, n=479; and

(5) Arteriography (for renovascular hypertension), 19 studies, n=875.

Methods of combining primary studies
Data were analysed using meta-analysis with an adjustment factor for sample size.

Investigation of differences between primary studies
Race, age, sex and minor technical variations were disregarded and no significant qualitative difference between studies was identified.

Results of the review
The calculated study-adjusted sensitivity values were:

diagnostic test captopril renogram (for renal artery stenosis) : 89% (86,92),

captopril renogram (for renovascular hypertension): 90% (88,92),
captopril test: 61% (54,68), and
doppler: 90% (86,94)

The respective specificity values were 92% (89,95), 86% (79,83), 86% (83,89), and 98% (97, 99).

The positive predictive values (30% renal artery stenosis) for:
diagnostic test captopril renogram (for renal artery stenosis) was 83% (78,88),
captopril test was 65% (60,70),
doppler was 95% (88,100), and
arteriography (for renovascular hypertension) was 100%.

The positive predictive values (for renovascular hypertension) for
diagnostic test captopril renogram (for renal artery stenosis) was 64% (60,68),
captopril renogram (for renovascular hypertension) was 66% (56,76),
captopril test was 50% (46,54),
doppler was 73% (68,78), and arteriography (for renovascular hypertension), was 77% (74,80).

Measure of benefits used in the economic analysis
Outcomes were: sensitivity, specificity, positive predictive value.

Direct costs
Estimation of the quantities of resources was based on actual data. Fees for the various diagnostic and therapeutic procedures (angioplasty and surgical repair) were obtained from the Charge Master of the Montefiore Medical Centre for 1993. Costs of two- and three-drug medical regimens were determined using data from the 1993 Red Book and adding a 10% retail mark-up plus a $2.00 pharmacy fee per 100 units of medication. Average cost of medications per year, lifetime costs (for two and three drugs) plus 10% retail mark-up, diagnostic charges and cost per patient were calculated. The diagnostic and therapeutic cost per 1000 patients was based on a 77% cure or improvement rate by angioplasty. There was nothing mentioned with respect to marginal and average costs.

Currency
US dollars ($)
captopril renogram (for renal artery stenosis), captopril renogram (for renovascular hypertension), captopril test, Doppler, and arteriography (for renovascular hypertension), were 64% (60.68), 66% (56.76), 50% (46.54), 73% (68.78), and 77% (74.80), respectively.

Cost results
Diagnostic charges were:

(1) $799 for captopril renography,
(2) $745 for renal ultrasound with doppler,
(3) $300 for the captopril test and
(4) $1,727 for renal angiography.

Therapeutic procedure charges were $3,354 for renal angioplasty ($1,305 for an average 2-night stay). Total costs were $5,964. The cost for surgical repair of renal artery stenosis including hospitalisation was $18,107.

The diagnostic and therapeutic cost per patient screened based on a 77% cure or improvement rate by angioplasty was:

(1) $15,793 using angiography,
$14,041 using doppler ultrasonography,
$14,875 using captopril renography (renal artery stenosis),
$13,554 using captopril renography (renovascular hypertension), and
$13,881 using the captopril test.

An average cost of medications for pharmacologic treatment of renovascular hypertension with two drugs was calculated to be $680 per year, and the lifetime costs was calculated at $13,600 based on an average 20 years of treatment. If a third drug was added to the medical regimen, then the lifetime cost was estimated to be $21,600.

Synthesis of costs and benefits
The most cost-effective screening test proved to be captopril renography in detecting renovascular hypertension, with savings of $46 or $8,046 for two and three drug regimens, respectively. The least cost-effective test was arteriography, which showed a loss of $2,193 compared with a two-drug regimen and a savings of $5,807 compared with three-drug regimen.

Authors' conclusions
If the patient was azotemic, most of the screening tests were less effective. If restoration of renal function was an important consideration, then arteriography, although the most expensive approach, was the most effective. Patients with well preserved renal function may be effectively screened with any of the available tests, although captopril appeared to be the most cost-effective. Renography also offered the benefit of providing lateralizing information and was a useful non-invasive test for patient follow-up if an intervention was performed. The test was also preferable in diabetic patients and those with unknown contrast media sensitivity who may be at some risk even with administration of non-ionic contrast.

CRD Commentary
The study design was sufficient to answer the question posed. However, although the authors specified an inclusion criteria with respect to the literature search, there was no indication of the "types" of studies included for final analysis.
(i.e., were the studies randomised controlled trials, or non-randomized trial with concurrent controls, non-randomized trial with historical controls, etc.). Information is required regarding what “types” of study were included in the meta-analysis and the guidelines used to evaluate each type of study as this may have a bearing on the internal validity of the final analysis. The meta-analysis performed did adjust for sample size and the MEDLNE search was over the period 1988-1993. Costs from the complications of hypertension, medication and laboratory tests were not factored into the analysis and were assumed to be similar for the two groups.

**Implications of the study**
These data provide some guidelines for selecting a screening test and deciding which patients benefit the most from particular tests. Although angioplasty is potentially a highly cost-effective treatment, surgical therapy appears prohibitive except in highly selected patients.

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