Routine preoperative testing: a systematic review of the evidence
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Authors' objectives
To review the available evidence on the value of routine pre-operative testing in healthy or asymptomatic adults; to assess the completeness of existing reviews of pre-operative testing and their applicability in a UK setting; and to identify areas for further research.

Searching
MEDLINE, EMBASE, Biological Abstracts, the Science Citation Index, HealthSTAR, DARE, NHS EED and the Cochrane Library were searched; the search strategies were given. MEDLINE was searched from 1966 to 1996; searches of the other databases focused on studies published since 1989. The bibliographies of reviews and primary studies were also examined.

Study selection
Study designs of evaluations included in the review
No inclusion criteria relating to the study design were specified. All the included studies were case series. No controlled studies were found to have been published for any of the six categories of pre-operative test.

Specific interventions included in the review
Studies of routine pre-operative testing, (defined as tests ordered for an asymptomatic, apparently health individual in the absence of any specific clinical indication, to identify conditions undetected by clinical history and examination) were eligible for inclusion. This included chest X-ray, electrocardiography (ECG), haemoglobin measurement and blood counts, tests of haemostasis, serum biochemical testing, and urine testing.

Reference standard test against which the new test was compared
The review did not include any diagnostic accuracy studies that compared the performance of the index test with a reference standard of diagnosis.

Participants included in the review
Patients of any age group and all surgical specialties were considered. However, papers relating only to specialist anaesthetic practice, such as obstetric or cardiothoracic anaesthesia, were excluded since two prior reviews that included these patient groups were identified.

Outcomes assessed in the review
No inclusion criteria relating to the outcome measures were specified. The main outcomes were: the percentage of abnormal and significantly abnormal test findings; evidence of a change in management as a result of the test results; and the incidence of adverse events in patients with an abnormal test finding.

How were decisions on the relevance of primary studies made?
One reviewer selected the papers for the review.

Assessment of study quality
Each paper was critically appraised, although the actual quality criteria used were not given. One reviewer performed the quality assessment.

Data extraction
One reviewer extracted data on the outcomes onto a standard form.
Methods of synthesis
How were the studies combined?
The studies were combined mainly in a narrative review, although the median values and ranges for the outcome variables were also reported.

How were differences between studies investigated?
The authors did not state how differences between the studies were investigated.

Results of the review
Chest X-ray: 46 studies were identified, of which 28 reported useable data. The size of the included studies varied from 100 to 3,866 participants.

ECG: 30 studies were identified, of which 16 reported usable outcome data. The size of the included studies varied from 12 to 3,866 participants.

Haemoglobin measurement and blood counts: 23 studies reported usable outcome data. The size of the included studies varied from 52 to 3,866 participants.

Haemostasis: 23 studies reported usable outcome data. The size of the included studies varied from 52 to 3,866 participants.

Pre-operative biochemical testing: 8 studies reported usable outcome data. The size of the included studies varied from 200 to 3,866 participants.

Urine testing: 11 studies reported usable outcome data. The size of the included studies varied from 147 to 3,987 participants.

Chest X-ray: few studies allowed the outcome of routine chest X-rays to be distinguished from those of indicated chest X-rays; fewer still examined the impact of abnormal findings on clinical management. Findings from routine pre-operative X-rays were reported as abnormal in 2.5 to 37% of cases, and led to a change of management in 0 to 2.1% of cases. Abnormality yield and impact on patient management rose with age and poorer American Society of Anesthesiologists (ASA) status. The limited evidence suggested that pre-operative chest X-ray will be of value as a baseline measure in fewer than 9% of cases.

ECG: the findings were abnormal in 4.6 to 31.7% of cases, and led to a change of management in 0 to 2.2% of cases. The effect on patient outcomes was unknown. Abnormality yield rose with age and poorer ASA status. The predictive power of pre-operative ECGs for post-operative cardiac complications in non-cardiopulmonary surgery was weak. There was no evidence to support the value of recording a pre-operative ECG as a baseline.

Haemoglobin measurement and blood counts: routine pre-operative measurement showed that haemoglobin levels may be lower than 10 to 10.5 g/dL in up to 5% of patients, but that they are rarely lower than 9 g/dL. The routine test led to a change of management in 0.1 to 2.7% of patients. Routine pre-operative measurement showed that the platelet count was abnormally low in less than 1.1% of patients and that platelet count results rarely, if ever, lead to changes in patient management.

Tests of haemostasis: abnormalities of bleeding time, prothrombin time and partial thromboplastin time were found in up to 3.8, 4.8 and 15.6% of routine pre-operative tests, respectively. The results of these tests very rarely lead to changes in the clinical management of patients.

Biochemistry: in routine pre-operative tests of serum biochemistry, abnormal levels of sodium or potassium were found in up to 1.4% of patients; abnormal levels of urea or creatinine were found in up to 2.5% of patients; and abnormal levels of glucose were found in up to 5.2% of patients. These abnormalities rarely lead to changes in the clinical management of patients.

Urine testing: routine pre-operative urinalysis found abnormal results in 1 to 34.1% of patients, and led to a change of
management in 0.1 to 2.8% of patients. The only abnormality that led to a change in the management of patients was the finding of white blood cells in the urine. There was no good evidence to suggest that pre-operative abnormal urinalysis is associated with any post-operative complication in non-urinary tract surgery. There is little or no apparent value in routine pre-operative urinalysis as an opportunist screening test for unrelated test, since even when abnormalities are found they evoke no change in clinical management.

**Authors' conclusions**

For the tests reviewed, a policy of routine testing in apparently healthy individuals is likely to lead to little, if any, benefit. However, it is possible that routine testing could be beneficial in asymptomatic patients in defined groups, such as those over a given age, although there is no evidence for or against such a possibility.

**CRD commentary**

The review addressed a clear and comprehensive research question. The inclusion criteria were partially defined and the review methodology, though subject to the limitations of conduct by a single researcher, was clearly reported. The authors' conclusions follow from the evidence presented. It would probably be useful to read the full review in conjunction with the two earlier reviews (see Other Publications of Related Interest nos.1-2).

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** Future primary studies should investigate whether routine testing would be of benefit in a clearly defined, asymptomatic population who are potentially at risk of post-operative complications. Secondary research should consider measures of diagnostic accuracy for each test in predicting post-operative events. Economic modelling of the likely resource costs and patient benefits of current practice should also be undertaken.

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