materials to support a phased implementation of contingency management, support staff training and supervision programmes, and assess the relative value of different incentive systems.

Contributors: SP drafted the paper, and all authors contributed to its revision and the final draft. SP convened both guideline development groups. JS chaired the NICE guideline on psychosocial interventions, and CG chaired the NICE guideline on detoxification.

Competing interests: Both JS and CG have received funding from pharmaceutical companies and government agencies for advisory services, and both are members of the UK Department of Health Clinical Guidelines on Drug Misuse and Dependence Group.

Funding: The National Collaborating Centre for Mental Health was commissioned and funded by the National Institute for Health and Clinical Excellence to write this summary.

Provenance and peer review: Commissioned; not peer reviewed.

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INTERACTIVE CASE REPORT

A patient with suspected miscarriage is found to have hypertension, renal failure, and thrombocytopenia: case outcome

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Accepted: 2 April 2007

BMJ 2007;335:205-8
doi: 10.1136/bmj.39239.479560.80

This is the final part of a three part case report, which describes the outcome and summarises the comments made by readers during the presentation of a real patient's story. Further responses are welcome through bmj.com

Four weeks ago we described the case of a 46 year old woman who presented with possible miscarriage, severe hypertension, acute renal failure, pulmonary oedema, microangiopathic haemolytic anaemia, and seizures (*BMJ* 2007;334:1372. 30 June). The diagnoses we considered are malignant hypertension, intrinsic renal disease, a primary microangiopathic process—such as haemolytic uraemic syndrome or thrombotic thrombocytopenic purpura, or eclampsia with HELLP syndrome. She was started on intermittent haemodialysis, an angiotensin converting enzyme inhibitor, and plasma exchange (*BMJ* 2007;335:44. 7 July). A magnetic resonance imaging scan of the brain showed posterior leucoencephalopathy consistent with hypertensive encephalopathy.

Her platelet count, metabolic abnormalities, and breathlessness improved and she had no further seizures. At one week she was well but remained dependant on dialysis. Bisoprolol and amlodipine were added to control her blood pressure.

Renal Doppler ultrasound showed poor renal perfusion so we performed angiography to exclude renovascular disease. This showed normal renal vessels (fig 1), suggesting a microangiopathic infrarenal process.

Renal biopsy demonstrated florid myxoid intimal thickening in interlobular arteries (fig 2), widespread acute tubular damage, and glomerular ischaemic changes. There was little thrombotic change to suggest haemolytic uraemic syndrome or thrombotic thrombocytopenic purpura. These appearances are consistent with a diagnosis of malignant hypertension or scleroderma renal crisis.

The table summarises the other investigations and blood tests. These were negative except for a strongly positive speckled antinuclear antibody at a titre of more than 1/1000. The staining pattern was consistent with anti-RNA polymerase antibodies and this was confirmed with immunoprecipitation.

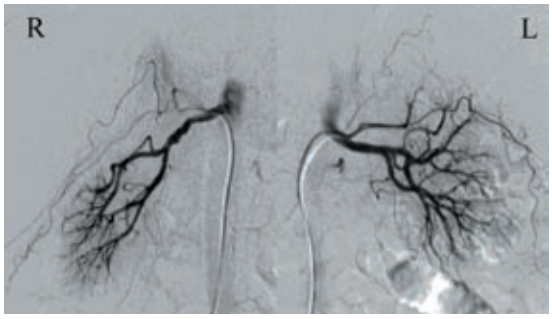

Fig 1 The patient's bilateral renal angiography showing normal renal vessels

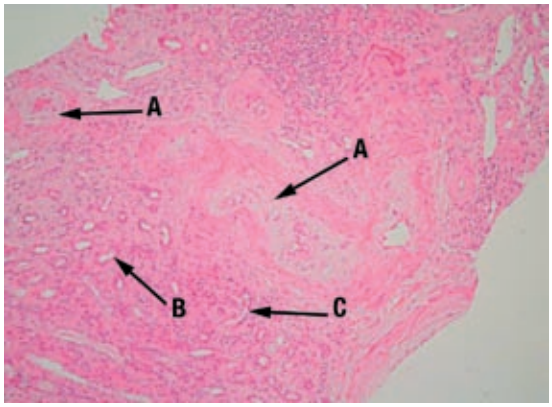

Fig 2 The patient's renal biopsy showing florid myxoid intimal thickening in interlobular arteries (A), widespread acute tubular damage (B), and glomerular ischaemic changes (C)

Anti-RNA polymerase antibodies are strongly associated with scleroderma renal crisis, and we consider

The patient's immunological profile and results of other investigations

Investigation	Result (normal range)
Antinuclear antibody	Positive, speckled >1/1000; anti-RNA polymerase
Anti-neutrophil cytoplasmic antibody	Negative
Anti-glomerular basement membrane antibody	Negative
Anti-scleroderma-70 antibody	Negative
Anti-topoisomerase antibody	Negative
Rheumatoid factor	Negative
Anti-double stranded DNA antibody	Negative
Anti-complement C1q antibodies	Negative
Complement C3	1.11 g/l (0.7-1.7)
Complement C4	0.18 g/l (0.16-0.54)
Anti-phospholipid/anti-cardiolipin antibody	Negative
IgG	5.9 g/l (5.3-16.5
IgA	0.96 g/l (0.8-4.0)
IgM	0.53 g/l (0.5-2.0)
Renal angiography	Normal
Magnetic resonance imaging of adrenals	Normal
Spot plasma adrenaline	0.76 nM (0.00-1.00)
Spot plasma noradrenaline	3.2 nM (0-5.0)
Random adrenocorticotrophin	5.1 ng/l
Random cortisol	222 nM
Long dexamethasone suppression test final cortisol	80 nM

this to be the diagnosis. Her hypertension may have precipitated miscarriage on this occasion, but the cause of the earlier miscarriages is less clear.

Scleroderma renal crisis primarily affects young and middle aged women and presents with acute renal failure and hypertension. There may be no prior symptoms of systemic sclerosis, but the history of Raynaud's offered a diagnostic clue in this patient. Other features of malignant hypertension such as encephalopathy, seizures, pulmonary oedema, and microangiopathic haemolytic anaemia may complicate this illness.

Angiotensin converting enzyme inhibitors may facilitate microvascular remodelling and prevent progression of renal impairment; they are used widely in this disease. Intravenous vasodilatory therapy, usually with prostacyclin, is recommended, and dialysis may be required. The benefit of plasma exchange in secondary microangiopathy is controversial and was instituted in this case because initially we could not exclude thrombotic thrombocytopenic purpura as a primary diagnosis.

The prospects for renal recovery are poor in patients who need dialysis at diagnosis. This patient is currently well on haemodialysis three times a week, although she still requires oral antihypertensives. She is currently awaiting renal transplantation.

Contributors: CDP is guarantor.

We welcome contributions of interactive case reports. Cases should raise interesting clinical, investigative, diagnostic, and management issues but not be so rare that they appeal to only a minority of readers. Full details of criteria are available at: bmj.com/cgi/content/full/326/7389/564/DC1

Commentary: Nephrologist

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BMJ 2007;335:206-7
doi: 10.1136/bmj.39279.588507.80

A clotting screen is essential to differentiate between causes of microangiopathic haemolytic anaemia. These can be either thrombotic microangiopathy or disseminated intravascular coagulation, possibly related to an obstetric calamity, sepsis, malignancy, or acute inflammation such as acute pancreatitis. In this case, normal clotting studies support the diagnosis of thrombotic microangiopathy.

The box lists the causes of thrombotic microangiopathy. In each situation, end organ injury will be exacerbated by hypertension. For this patient, initial management must focus on urgent treatment of her accelerated hypertension, which may even switch off the thrombotic microangiopathy. She needs immediate admission to a unit with facilities for invasive monitoring. Intravenous furosemide and nitrate infusion are appropriate if clinical signs of fluid overload are present. In acute renal failure, the response to furosemide is usually poor, and haemofiltration (or haemodialysis) should be started early. However, circulating volume can be reduced in accelerated hypertension and medical management is different, with arterial vasodilation needed rather than diuresis and venodilation.

In this case, the differential diagnosis includes haemolytic uraemic syndrome-thrombotic thrombocytopenic purpura—possibly associated with pregnancy or shigatoxin—anticardiolipin antibody syndrome, and scleroderma renal crisis. In idiopathic haemolytic uraemic syndrome-thrombotic thrombocytopenic purpura, vascular injury occurs in the context of reduced factor H activity, reduced ADAMTS13 (von Willebrand factor cleaving protease) due to an acquired antibody, or reduced concentrations of other complement regulatory proteins. Some patients may benefit from infusion of plasma (or plasma cryosupernatant), which may replace or augment the missing factors. Although plasma exchange is often used, the evidence is not strong, and benefit may be limited to patients with

Causes of thrombotic microangiopathy

- Malignant hypertension
- Scleroderma renal crisis
- Haemolytic uraemic syndrome-thrombotic thrombocytopenic purpura (idiopathic, familial, pregnancy related, shigatoxin positive or negative)
- Anticardiolipin antibody
- HIV
- Chemotherapy
- Snake bites

antibodies to ADAMTS13 or problems with volume overload.[1]

The pregnancy test is negative in this patient and she has no history of shigatoxin infection. Her miscarriages probably occurred during the first trimester, and the normal activated partial thromboplastin time excludes a lupus anticoagulant, although anticardiolipin antibodies could still be present. The history of Raynaud's phenomenon raises the possibility of underlying connective tissue disease. A diagnosis of acute scleroderma renal crisis is supported by the presence of strongly positive antinuclear antibodies and anti-RNA polymerase antibodies, together with the renal histology. Absence of cutaneous changes is unusual, however, and might favour a unifying diagnosis of accelerated hypertension with incidental serology. In a recent report of 115 cases of acute scleroderma renal crisis, patients were mostly female (81%), had diffuse cutaneous disease (78%) and anti-RNA polymerase antibodies (59%), and outcome was predicted by renal histology.[2]

The renal biopsy was consistent with accelerated hypertension or scleroderma renal crisis with widespread ischaemia. Doppler ultrasound showed poor renal perfusion with normal proximal arteries confirmed on renal angiography. By this stage, the diagnosis was much clearer and a dynamic renogram would have confirmed minimal uptake with poor prognosis due to irreversible tissue injury and avoided the need for selective angiography.

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2 Penn H, Howie AJ, Kingdon EJ, Bunn CC, Stratton RJ, Black CM, et al. Scleroderma renal crisis: patient characteristics and long-term outcomes. *QJM* 2007 Jun 29 Epub ahead of print.

Commentary: View from clinical education

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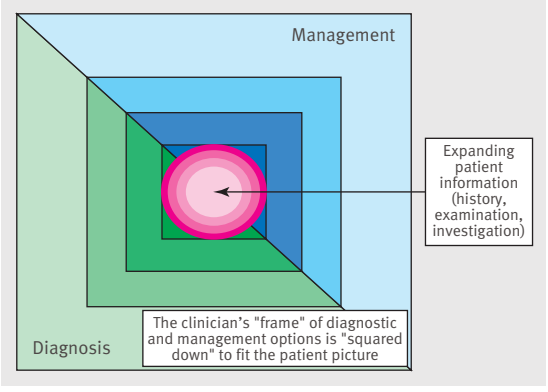
BMJ 2007;335:207-8
doi: 10.1136/bmj.39279.642836.80

This interactive case discussion is interesting from an educational viewpoint. The case presentation is one of the most complex that has featured in this series, and it attracted thoughtful responses from clinicians of many specialties and levels of experience. It was good to see a medical student reasoning his way through the dilemmas posed by this patient's presentation. Most responses showed evidence of more than a "stab in the dark" approach to diagnosis and management of the complex case.[1]

Clinical reasoning approaches in the responses included generating diagnostic hypotheses and testing them; using pattern recognition; and the process of "chunking" information and constructing schema excluding some pathways and exploring others (such as acute or chronic renal failure; primary or secondary hypertension). These processes are used by experts and novices alike (in differing proportions and to different effect) in test situations.[2]

What is less certain is how clinicians respond to complex and demanding cases like this, where the stressful situation involves volatility, uncertainty, complexity, ambiguity, and delayed feedback and information flow (VUCAD).[3] We need more evidence about the reasoning processes that clinicians use in complex medical situations (rather than evidence from artificial tests of reasoning used in research) if we are to understand, let alone teach, the skills that clinicians need to determine appropriate priorities in managing a case presentation such as this.



Simple model for teaching clinical reasoning in complex situations

Comprehensive mapping of clinical judgments, decision making, and analysis led Jack Dowie to stress the importance of a comprehensive Bayesian stochastic decision model that places equal weight on knowledge and input of values.[4] But can we realistically expect doctors to use such complex modelling processes when dealing with desperately ill patients?

For teaching purposes I illustrate the patient's presentation as a circle which expands as history, examination, and investigation add to our knowledge (figure). The clinician constructs a square frame composed of two adjacent sides that represent "diagnosis"

and two that represent "management." The clinician's frame is "squared down" to meet the expanding rings of the emerging patient picture. Actions result when the management possibilities are reduced to an appropriate choice to frame what we now know about our patient. The process is dynamic and is repeated when decisions are made. In this case, a decision to admit the patient is made early on, and the dialysis decisions of early management follow rapidly and logically. The diagnosis becomes clearer as emergency management proceeds.

Although research into understanding effective complex clinical decision processes is necessarily complex, we may benefit from keeping simple models in our heads as we teach.

Competing interests: None declared.

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Commentary: Author's reply

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BMJ 2007;335:208
doi: 10.1136/bmj.39280.407975.BE

We hope that readers have found this interactive case report interesting and educational. The rapid responses—from many countries, specialties, and grades—have been informative. We would like to thank *BMJ* readers for taking such an interest in the case and taking time to post their responses.

This patient presented with scleroderma renal crisis and features typical of accelerated hypertension—acute renal failure, pulmonary oedema, microangiopathic haemolysis, and hypertensive encephalopathy.

We agree with many responders that investigation for recurrent miscarriage was not necessary on the basis of the reproductive history alone, but that other features of her illness certainly warranted investigation. Investigation of accelerated hypertension may include endocrine testing, renovascular studies, serology, and renal biopsy. In our experience, white patients with this presentation often have an underlying cause.

As regards her management, basic resuscitation, adequate monitoring, and safe and timely transfer to a specialist unit were crucial. We used nitrates for pressure control in view of her volume overload and pulmonary oedema, followed by ultrafiltration and oral therapy. Some of the blood pressure agents suggested by responders would be equally efficacious, as would prostacycline. Most guidelines recommend initial lowering of diastolic pressure to 100-105 mm Hg over two to six hours, with an initial drop of no more than 25%. This can then be lowered to 85-90 mm Hg over several weeks. Acute dialysis (or haemofiltration) was clearly needed, and we felt early plasma exchange was justified given the possibility of primary TTP.

Our patient had an overwhelming illness, which evolved extremely rapidly—apparently "out of the blue." She had a fortnight of intensive treatment and investigation and then had to adjust rapidly to the prospect of long term dialysis. She coped with these demands remarkably well.

In spite of advances in technology, mortality from acute renal disease remains high. Patients with such disease often present to non-specialists. Early recognition and treatment, with early involvement of nephrology and critical care services, is essential for a good outcome.

Competing interests: None declared.

Knifeless lung surgery

The 70 year old patient had been admitted many times for exacerbations of his chronic obstructive pulmonary disease for the past several years, and he could barely walk despite the numerous bronchodilators and anticholinergic drugs he was taking. Recently, he was brought with severe breathlessness once again, but this time he did not respond and was referred to a tertiary care hospital for the management of respiratory failure.

He was put on a ventilator, and a few hours later he had a cardiac arrest. He was successfully resuscitated, but he then developed pneumothorax after the resuscitation. Fortunately, he responded well to ventilator therapy and intercostal drainage. A few days later he was discharged.

When he returned for follow-up, I noticed marked improvement in his dyspnoea. The beaming patient told me that he was cured of his disease. Examination and assessment of lung function confirmed his improvement. When I went through his discharge notes, I saw how his COPD had been "cured."

The patient has had large emphysematous bullae in either lung, and these were ruptured during cardiac resuscitation. Luckily, the resulting pneumothorax was managed effectively. These emphysematous bullae compressed the adjacent normal lung tissue, so their obliteration allowed normal functioning of the lung tissue. This resulted in marked improvement in lung function and clinical symptoms.

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