Additional file 2: Details of cohort studies and randomised trials

Reference	Design, numbers, treatments, duration	Patients	Main efficacy outcomes	Main adverse event outcomes
Randomised trials				
Ye et al. 2001 Abstract 274 R=1 DB=0 WD=0	Randomised open comparison of: MMF (45 patients) 1.5 g daily for 3 months, 1 g daily for 3 months, then 0.5 to 0.75 g daily IV cyclophosphamide (45 patients) 0.75g/sq metre per month for 6-12 months Prednisolone also available	Severe SLE with one or more of lung, renal, CNS involvement, hemolytic anaemia or vasculitic complications No ethnicity given WHO: no criteria given	MMF significantly improved clinical and laboratory parameters	GI intolerance, infection, leucopaenia, hair loss, liver dysfunction and ovarian failure less with MMF than cyclophosphamide
Flores-Suarez et al. ACR 2004 Abstract 1029 R=1 DB=0 WD=1	Randomised open comparison over 1 year of: MMF (10 patients) up to 2 g daily IV cyclophosphamide (10 patients) monthly Prednisolone given to all and reduced according to response	Patients with lupus nephritis (type IV and V). Patients broadly similar initially No ethnicity given WHO: 17 IV, 3 V	Based on urine protein excretion and creatinine clearance, results at last follow up were: Complete remission 1/10 IVC, 3/10 MMF Partial remission 1/10 IVC, 3/10 MMF Treatment failure 8/10 IVC, 4/10 MMF	Death: 3/10 IVC, 0/10 MMF Leucopoenia: 5/10, 1/10 Diarrhoea: 0/10, 2/10 Infections: 3/10, 5/10, (non severe) Total alopecia: 1/10, 0/10 Amenorrhoea: 1/10, 0/10
2004 350: 971-980	After IV cyclophosphamide induction, patients randomised to: 0.5-1 g/sq metre IV cyclophosphamide every three months (20 patients) 1-3 mg/kg azathioprine daily (19) 0.5 to 3 g MMF daily with dose titration (20) Oral prednisone or other corticosteroid allowed Duration 1-3 years Median dose of MMF1.5 g/day during first 12 months, and then decreased	Patients with SLE according to ARA criteria, and with histological diagnosis of lupus nephritis after biopsy (WHO class III or greater) No major differences between groups Average age 32 years 55 women, 2 men 3W, 27B,30 H WHO: 12 III, 46 IV, 1 V	Median duration of treatment was 25-30 months Chronic renal failure 3/20 IVC, 1/19 AZ, 1/20 MMF Renal relapse (increased protein creatinine ratio) 8/20 IVC, 6/19 AZ, 3/20 MMF Event free survival better for AZ and MMF than IVC, and relapse-free survival better for MMF than IVC	Death: 4/20 IVC, 0/19 AZ, 1/20 MMF (mostly infections) Hospital days per patient year 10 IVC, 1 AZ, 1 MMF Adverse events per patient year back calculated to number beginning therapy: Amenorrhoea: 6/18, 1/18, 1/19 Total infection: 15/20, 6/19, 6/20 Major infection: 5/20, 0/19, 0/20 Minor infection: 10/20, 5/19, 6/20 Leucopoenia: 2/20, 1/19, 0/20 Nausea: 13/20, 1/19, 3/20 Vomiting: 11/20, 1/19, 2/20 Diarrhoea: 2/20, 2/19, 2/20

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Chan et al. NEJM After biopsy, patients randomised to: Patients with SLE according to ARA Based on urine protein excretion and creatinine Death 2/21 IVC/AZ. 0/21 MMF criteria, and with histological diagnosis of Infection 7/21 IVC/AZ, 4/21 MMF 2000 343: 1156-1162. oral cyclophosphamide 2.5 mg/kg/day clearance, results at 12 months were: plus prednisolone (21), replaced by lupus nephritis after biopsy (WHO class IV) Complete remission 16/21 IVC/AZ,17/21 MMF Leucopoenia 2/21 IVC/AZ, 0/21 MMF R=1 azathioprine at 6 months, or No major differences between groups Partial remission 3/21 IVC/AZ, 3/21 MMF Hair loss 4/21 IVC/AZ. 0/21 MMF DB=0 oral MMF 2 a daily plus oral Average age 37 years Treatment failure 2/21 IVC/AZ, 1/21 MMF Amenorrhoea 3/21 IVC/AZ, 0/21 MMF WD=1 prednisolone (21), with dose halved at 6 39 women, 3 men Relapse 2/21 IVC/AZ, 3/21 MMF Diarrhoea 0/21 IVC/AZ, 1/21 MMF months, and replaced by azathioprine at Presumed all Chinese There were major reductions in urinary protein excretion Adverse event discontinuations 1/21 IVC/AZ, 1/21 12 months WHO: all IV in both treatments, to average values of 0.5 and 0.2 g daily, and significant reductions in serum creatinine and Hospital admissions for AE (episodes) 6/21 increase in serum albumin IVC/AZ, 3/21 MMF Chan et al. J Am Soc After biopsy, additional patients Patients with SLE according to ARA Response to induction was: Death: 2/30 IVC. 0/32 MMF Nephrol 2005 16: randomised to: criteria, and with histological diagnosis of Complete remission 23/30 IVC/AZ, 24/32 MMF Severe infections: [42 patients from Chan oral cyclophosphamide 2.5 mg/kg/day lupus nephritis after biopsy (WHO class IV) Partial remission 7/30 IVC/AZ, 7/32 MMF 1 in 103 patient months IVC/AZ, 1 in 234 patient-2000 plus additional plus prednisolone (30), replaced by No major differences between groups Longer term relapse: 9/30 IVC/AZ, 11/32 MMF, mostly months MMF patients] azathioprine at 6 months, or Average age 39 years with clear renal involvement. Hospital admission for infection 1 in 177 patient 52 women, 10 men months IVC/AZ. 1 in 328 patient-months MMF oral MMF 2 a daily plus oral Relapse-free survival the same in both maintenance R=2 prednisolone (32), 1.5q daily at 6 Presumed all Chinese Infections 12/30 IVC/AZ, 4/32 MMF groups: DB=0 months, and 1 q daily at 12 months WHO: all IV any disease relapse 9/30 IVC/AZ, 11/32 MMF Infections needing hospital admission 9/30 IVC/AZ, WD=1 Maximum duration was 84 months 2/32 MMF End-stage renal disease 2/30 IVC/AZ. 0/32 MMF Composite end point of renal failure or death (2) Doubled creatinine 2/30 IVC/AZ. 2/32 MMF deaths) 4/30 IVC/AZ, 0/32 MMF Adverse event discontinuations 3/30 IVC/AZ, 1/32 Leucopoenia 8/30 IVC/AZ, 0/32 MMF GI upset 1/30 IVC/AZ, 3/32 MMF Severe hair loss 9/30 IVC/AZ, 0/32 MMF Amenorrhoea 9/25 IVC/AZ (permanent in 5), 1/28 MMF Patients had newly diagnosed WHO III or Remission in 13/25 IVC, 11/19 MMF Ong et al. Nephrology Patients randomised to: There were no deaths 2005 10: 504-510. IV cyclophosphamide 0.75-1.0 g/sq IV lupus nephritis, and were aged 16 or Complete remission 3/25 IVC, 5/19 MMF Adverse event withdrawal 1/25 IVC. 0/19 MMF metre for six months plus older Proteinuria decreased with both treatments, with upward End-stage renal failure 0/25IVC, 1/19 MMF R=2 Average age 31 years, and 37 of 44 Oligomenorrhoea 1/25 IVC, 0/19 MMF corticosteroids (25) trend in serum albumin. DB=0 Oral MMF 2 g orally daily for six months patients were women Creatinine clearance rose over time, though was not Serious infection 3/25 IVC, 3/19 MMF WD=1 plus corticosteroids (19) all oriental different between treatments Any adverse events 72 IVC, 68 MMF Dose adjustements were allowed for WHO: 4 III, 40 IV adverse events, with dose reduction for Long-term follow up several years after the six-month prednisolone from 40-60 mg daily to induction period shwed no major differences between maintenance of 5-10 mg daily patients whose induction had been with IVC or MMF. Mean daily dose of MMF was 1.6 q Patient survival was 94% and kidney survival 92% for both groups at 36 months

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Ginzler et al. NEJM 2005 353: 2219-2228 R=2 DB=0 WD=1	Patients randomised to: IV cyclophosphamide 0.5 g/sq metre increasing to 1.0 g/sq metre, at monthly intervals (69) Oral MMF 1 g daily to maximum of 3 g daily (71) Duration was 3 months, and those with satisfactory response continued for a further 6 months, while those without a satisfactory response crossed to the other regimen, and after this period a further possible crossover was possible All patients received prednisone or other corticosteroid Mean daily dose of MMF 2.7 g daily	Average age 32 years 126 women, 14 men 24W, 79B, 28H, 9 other WHO: 22 III, 76 IV, 27 V	Response to induction was: Complete remission 4/69 IVC, 16/71 MMF Partial remission 17/69 IVC, 21/71 MMF No remission at 24 weeks on initial regimen 21/69 IVC, 19/71 MMF Serum creatinine and urine protein excretion fell with both treatments, and serum albumin increased. Oral corticosteroids could be tapered over 3-6 months After about 36 months follow up, renal failure or death were twice as frequent after IVC (7 and 8 cases respectively) than after MMF (4 cases each)	Death: 2/69 IVC, 0/71 MMF Withdrawal treatment failure 3/69 IVC, 5/71 MMF Total withdrawal 24/69 IVC, 15/71 MMF Adverse event withdrawal 3/69 IVC, 1/71 MMF At least one adverse event 24/75 IVC, 20/83 MMF (including crossover) Severe infection 6/75 IVC, 1/83 MMF Any infection 68/75 IVC, 42/83 MMF Upper GI symptoms 25/75 IVC, 23/83 MMF Diarrhoea 2/75 IVC, 15/83 MMF Amenorrhoea 2/75 IVC, 0/83 IVC Sustained lymphopenia 14/75 IVC, 5/83 MMF Nausea and vomiting hospital admission 7/75 IVC, 0/83 MMF Rectal bleeding 3/75 IVC, 0/83 MMF
Cohort studies in SLE	E patients with only lupus nephritis			
•	Prospective cohort of 13 patients followed up for 2-24 months MMF doses began at 0.5 to 2 g daily, to maximum of 1.0 to 2.5 g daily	previous therapy	Over 13 months average treatment, there was a significant reduction in proteinuria (PC ratio fell from 5.5 to 2.9), and serum creatinine was stable or improved (mean fall 149 to 123 μ mol/L) Abnormal urine sediment in 13/13 initially, 7/13 at 13 months Prednisone dose reduced in 10/13, eliminated in 2/13	1/13 discontinued because of pancreatitis (MMF-related) 1/13 had period of leucopaenia 1/13 had scalp hair loss 3/13 mild nausea or diarrhoea 1/13 severe nausea, vomiting and diarrhoea
Kingdon et al. Lupus 2001 10: 606-611.	Prospective cohort of 13 patients followed up for 6-37 months Median maintenance dose was 1 g daily (range 250 mg to 3 g daily)	had deteriorating renal function. All had	Over 25 months average treatment, nephrotic relapse occurred in 1/13, though MMF was re-introduced Disease severity scores fell in 12/13 Mean proteinuria fell from 1.5 g daily to 0.9 g daily Oral corticosteroids reduced 6/10 or stopped 2/10	1/13 withdrew non-compliance 1/13 withdrew because of severe nausea 3/13 moderate/severe infections 2/13 GI symptoms 0/13 severe leucopaenia or anaemia
Hu et al. Chin Med J 2002 115: 705-709.	Prospective open non-randomised trial in 46 patients followed for 45 months MMF initial dose 1-1.5 g daily, reduced to 0.5 to 1 g daily Cyclophosphamide intravenously followed by pulsed therapy to dose of 2-3 grams, followed by prednisone 0.8 mg/kg/day. IV cyclophosphamide at 0.75 to 1.0 g/sq metre given monthly for six months, then quarterly	All had SLE according to ARA criteria, urine sediments and proteinuria, renal biopsy showing lupus nephritis, and without severe concomitant disease Average age 29 years 38 women, 8 men Presumed all Chinese WHO: all IV	Over 45 months follow up, 21/23 on MMF had more than 50% reduction in urinary RBC, and 16/21 in urinary protein excretion. For 8/23, urine protein excretion was below 0.5 g daily Repeat renal biopsy showed improvements	Adverse events were: 2/23 herpes zoster 6/23 GI symptoms 4/23 infections 0/23 leucopaenia

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Spetie et al. Kidney Int Prospective cohort of 13 2004 66: 2411-2415. MMF doses were 1 g da 1.5 to 2 g daily by 2-4 we	4-30 months criteria, with no immunosuppressive ly initially, then therapy before onset of nephritis	Mean treatment duration was 16 months. By six months of therapy, 10/13 achieved complete (8) or partial (2) remission, with 11/13 at longest follow up. Oral prednisone reduced in 12/13 patients Reduction in proteinuria	Serious adverse event 1/13 infection 1/13 mild diarrhoea 0/12 leucopaenia or anaemia
Kim et al. EULAR 2004, Abstract 0360 Cohort of 46 patients wit nephritis treated with MN months Dose not given	h lupus No additional patient details given	Complete remission 26/46 Partial remission 7/46 Relapse after complete remission 2/46 No response 13/46 Improved ESR and serum albumin, decreased proteinuria and steroid dose reported	Gastrointestinal problems affected 28/46, with hair loss, leucopaenia, anaemia, infection, myalgia and headache mentioned, but no severe adverse events
Ding et al. Lupus 2004 Prospective cohort of 9 p 13: 113-118. lupus nephritis followed months MMF dose 1-2 g daily fo with subsequent reduction	up for at least 6 Age range 14-39 years 6 women, 3 men r three months, Presumed all Chinese	After 6 months, all 9 patients were free of systemic symptoms, with significant fall in protein excretion and haematuria. Disease activity indices improved 4/9 complete remission (protein excretion <1 g daily) 4/9 partial remission (protein excretion 1-2 g daily) 1/9 failed treatment	Gastrointestinal adverse events were described as tolerable
Kapitsinou et al. Rheumatol 2004 43: 377-380. Retrospective cohort of lupus nephritis followed months MMF dose 2 g daily			2/18 gastrointestinal intolerance needing dose changes
Borba et al. ACR 2005 Prospective cohort of 20 Abstract 1129 SLE and proteinuria follo average of 12 months Initial MMF dose of 1.5 g increased to 2-3 g daily a	wed up for an proteinuria despite corticosteroids. 12 patients had biopsy documented membranous glomerulonephritis	Partial response (≥50% decrease in proteinuria) in 20/20, with mean protein excretion down from 3.5 g to 1.3 g daily, and significant increase in serum albumin, after 8 months Complete response (normal urine protein excretion of <0.3 g daily) in 11/20 after 12 months, with mean urine protein of 0.2 g daily. No response in 3/20 patients Oral prednisone fell from an average of 34 mg to 2 mg daily	No information given

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Karim et al. Rheumatology 2005	Retrospective cohort of 10 patients, with follow up 3-52 months	Biopsy-proven lupus membranous nephropathy	Mean treatment duration 19 months Disease severity scores fell in 3/6 patients	2/10 infections (not obviously severe) 5/10 GI symptoms
44: 1317-1321.	MMF starting dose 0.5 g daily to maximum of 1.0 to 2.5 g daily	9/10 fulfilled ACR criteria for SLE Previous therapy azathioprine, cyclosporine, and cyclophosphamide Age range 30-49 years 8 women, 2 men 5W, 5B WHO: all V	ESR fell in 7/8 patients Serum creatinine fell in 6/10 Urine protein excretion fell in 9/10 patients, especially at higher initial excretion rate (median 2.3 initially to 0.7 at last follow up Serum albumin levels increased significantly Daily prednisolone reduced in 8/10	1/10 discontinuation due to GI symptoms
Cross et al. Nephron Clin Pract 2005 100:c92-c100.	Prospective cohort of induction regimen in 24 patients with lupus nephritis for 1 year (19 completed 1 year) MMF initially 1 g daily, to 2 g daily over 4 weeks, with prednisolone	All patients had renal biopsy proven lupus nephritis. No patient previously treated with MMF or cyclophosphamide Average age 33 years 21 women, 3 men 18W, 3B, 3 other WHO: 4 III, 11 IV, 9 V	At 6 months, 20/24 had complete renal remission , 2/24 partial remission, 2/24 refractory At 12 months 5/20 now had only partial remission Urine protein excretion fell from 3.9 to 1.3 g daily, while serum albumin rose from 28 to 37 g/L. Anti-dsDNA titres also fell.	5/24 withdrawn (2 refractory, 1 serious infection, 1 flare in extra-renal disease, 1 continuing disease). Other adverse events were: 9/24 infections 4/24 Gl 3/24 venous thrombosis 1/24 thrombocytopoenia

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Cohort studies that in	cluded SLE patients without lupus ne	ohritis		
Gaubitz et al. Lupus 1999 8: 731-736.	Prospective cohort of 10 patients with follow up 8-16 months MMF 1.5 or 2 g daily, depending on weight	ACR defined SLE, >12 SLAM, 16-65 years Corticosteroids, antimalarials, and other therapies used at start. 4/10 with nephritis Age range 16-46 years All women No ethnicity given WHO: 1 II, 3 IV	Over 11 months average treatment, SLAM 16 initially reduced to 10 and 8 at 3 and 6 months; 8/10 >20% reduction in SLAM at 6 months SLE-related erythema improved in 5/5, and arthritis in 5/6 ESR reduced, and mean prednisolone dose reduced from 10 to 5 mg daily	. •
Karim et al. Rheumatol 2002 41: 876-882.	Prospective cohort of 21 patients followed up for 0.5 to 33 months MMF starting dose was 0.5 g daily to a maximum of 2 g daily	At least four of ACR criteria for SLE, mostly previously treated with immunosuppressants. 13 patients had active renal disease at entry Age range 21 to 47 years 20 women, 1 man 12W, 8B, 1 other WHO: 1II, 4 III, 6 IV, 2 V	Over 14 months average treatment, disease activity scores fell from 13 initially to 4 at the last visit Proteinuria fell from 3.7 to 1.1 g daily Prednisolone reduced from mean 20 mg daily to 10 mg daily (15/16)	3/21 withdrew because adverse events, mainly gastrointestinal 2/21 wished to become pregnant 2/21 moderate or severe infections 1/21 leucopaenia
Doria et al. ACR abstract 1464, 2003	Prospective cohort of 42 patients, followed up for 2-24 months (28 followed up for 9 months) MMF dose was 2 g daily with prednisone	SLE patients with: glomerulonephritis (15) thrombocytopoenia (2) arthritis (6) CNS involvement (2) glomerulonephritis after standard induction therapy (14) Age range 21-49 years 37 women, 5 men No ethnicity given WHO: all IV	Over 11 months average treatment, there was a significant improvement in disease activity scores and reduction in prednisone dose. Proteinuria was reduced in patients with glomerulonephritis after induction therapy	Adverse events were: 6/42 adverse event withdrawals 3/42 treatment failure withdrawals 5/42 infections 4/42 nausea 3/42 abdominal pain 2/42 diarrhoea 3/42 dizziness, headache 1/42 leucopaenia
Riskella et al. J Rheumatol 2003 30: 1508-1512.	Retrospective consecutive patients (54), followed up for an average of 12 months MMF dose ranged from 125 mg to 3 g daily	SLE patients with confirmed diagnosis receiving MMF, about two-thirds receiving	Over 12 months average treatment there were significant improvements on disease activity scores, and significant reduction in daily prednisone (from 20 mg to 12 mg daily) with stable creatinine	2/54 serious adverse events

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Shekshina et al. EULAR 2003 abstract no.	Prospective cohort of 36 patients, with 29 completing at least 6 months treatment MMF 2 g daily	SLE patients inadequately controlled with corticosteroids, cytotoxics, cyclosporine or antimalarials; 19 patients had lupus nephritis Age range 17-51 years 32 women, 4 men No ethnicity given WHO: no criteria given	Overall improvements for clinical disease scoring, white cell counts, and serum protein and albumin in those with lupus nephritis. Proteinuria improved in 6/15 with nephritis. Also improved were erythema (3/9), skin vasculitis (2/4), arthritis/arthralgia (4/11), headache (5/12) Oral prednisolone decreased from mean 18 to 15 mg daily	Adverse events were: 2/29 treatment failure 4/29 adverse events (dizziness, nausea, allergy, thrombocytopoenia) 4/29 hair loss 2/29 nausea 2/29 abdominal pain 2/29 infections
Bijl et al. Ann Rheum Dis 2003 62: 534-539.	Prospective cohort of 10 patients with SLE with rising anti-dsDNA antibodies treated for 6 months with MMF MMF dose 2 g daily	SLE patients satisfied at least four ACR criteria Age range 22-63 years 9 women, 1 man No ethnicity given WHO: no criteria given	No patient had a clinical relapse on MMF. Significant fall in anti-dsDNA antibodies over treatment period. Patient assessment of improvement significant from 2-6 months	Minor hypertensive event in one patient requiring increased therapy, and one unconfirmed fever 0/10 leucopaenia or anaemia
Frassi et al. EULAR 2005 Abstract 0455	Prospective cohort of 25 patients with renal and nonrenal lupus resistant to conventional immunosuppressive therapy for 3-42 months MMF dose 0.5-2 g daily	All previously treated with various immunosuppressive drugs Age range 21-54 years 24 women, 1 man No ethnicity given WHO: no criteria given	After a median treatment duration of 18 months patients had reduced disease activity. Proteinuria and creatinine clearance not significantly different. No effect in 7/25 patients Significant reduction in oral prednisone from 12 to 11 mg daily	Adverse events in 14/25 patients 5/25 discontinued because of adverse events 7/25 Gl disorders 5/25 infections 1/25 CNS lymphoma 1/25 hypoglycaemia
Pisoni et al. J Rheumatol 2005 32: 1047-1052.	Retrospective cohort of 86 patients with SLE, 59 with lupus nephritis followed up for an average of 16 months Maximum MMF dose was 0.5 to 2.5 g daily	All patients had SLE according to ACR criteria. 59 had lupus nephritis and 29 uncontrolled disease activity. All patients had at least one immunosuppressive drug before MMF Average age 37 years 76 women, 10 men 44W,24B,18 other WHO: 11 III, 12 IV, 9 V	In all patients, there were reductions in steroid dose and activity index, and improvement in ESR. In 35 renal patients there was reduced proteinuria from 3.0 to 1.9 g daily.	Discontinuations because of adverse events occurred in 14/86 patients, mostly because of GI complaints or infections 12/86 discontinued because of lack of efficacy, 6/86 pregnancy Other adverse events were: 37/86 at least one adverse event 25/86 GI symptoms 20/86 infections 2/86 depression 1/86 haematological

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