Sheffield Teaching Hospitals: Pulmonary Hypertension

Information for Medical Staff 31/03/2014

Local guidelines

Diagnostic Pathway (from Kiely DG *et al* BMJ 2013;346:f2028 doi: 10.1136/bmj.f2028)

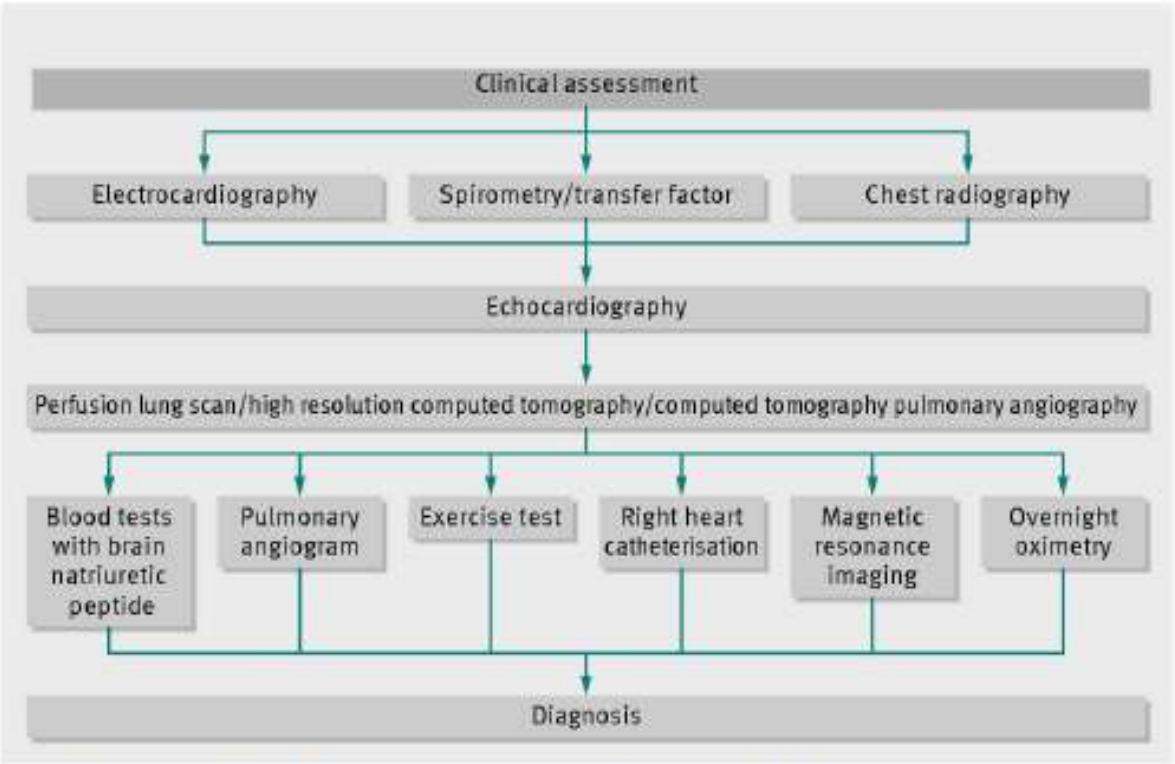
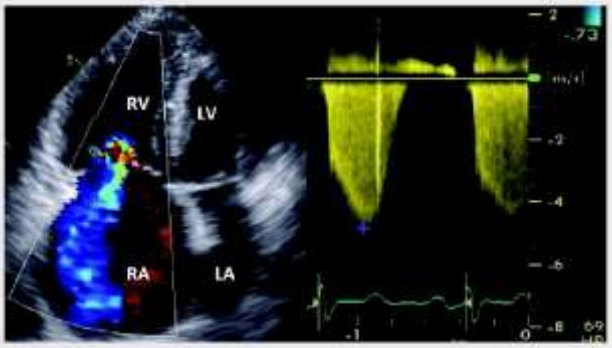


Fig 2 Diagnostic pathway for patients with suspected pulmonary hypertension

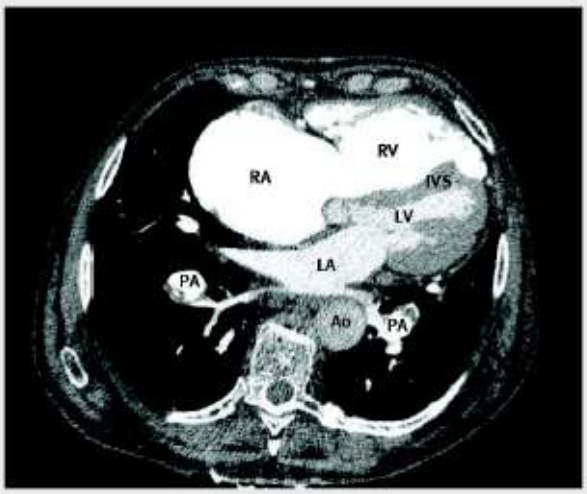


Estimation of systolic pulmonary arterial pressure (sPAP)
- Maximal tricuspid regurgitant jet velocity (V) measured using continuous wave Doppler
- RV systolic pressure (RVSP) calculated using equation: $RVSP = 4V^2$
- sPAP = RVSP + right atrial pressure (RAP)
- RAP estimated at 5 mm Hg unless size of interventricular septum suggests higher
- In this example sPAP = $4 \times (4.8)^2$ + RAP = 92 mm Hg + RAP

Other features suggestive of pulmonary hypertension
- Dilated right sided chambers
- Reduced RV function
- RV hypertrophy
- Enlarged pulmonary artery
- Abnormal interventricular septal motion

Likelihood of pulmonary hypertension
- Pulmonary hypertension unlikely
  - sPAP ≤36 mm Hg* with no other features of pulmonary hypertension
- Pulmonary hypertension possible
  - sPAP ≤36 mm Hg* + other features of pulmonary hypertension
  - sPAP 37-50 mm Hg*
- Pulmonary hypertension likely
  - sPAP >50 mm Hg*

*Including 5 mm Hg RAP



Features on this image
- Dilation of right sided chambers
- Flattening/posterior bowing of interventricular septum
- Presence of chronic thromboembolic disease in both lower lobe pulmonary arteries
- Normal sized left atrium

Other features that may be demonstrated using computed tomography pulmonary angiography
- Pulmonary artery: ascending aorta >1 suggestive of pulmonary hypertension
- Right ventricular hypertrophy
- Underlying lung disease
- Dilated left atrium and normal right ventricle in pulmonary hypertension of the left heart
- Mosaic parenchymal perfusion in CTEPH
- Congenital heart disease
  - Anomalous pulmonary venous drainage
  - Patent ductus arteriosus
- Bronchial artery hypertrophy in Eisenmenger's syndrome and CTEPH
- Dilated oesophagus in systemic sclerosis
- Splenomegaly in porto-pulmonary hypertension

Dosing Chart: *Ng/kg/min ILOPROST DILUTED up to 19 mls of Normal Saline Infusion rate = 2 mm/hour via syringe driver*

Weight of patient in Kg

Mcg (Iloprost)	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
50	0.99	0.82	0.71	0.62	0.55	0.49	0.45	0.41	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23
100	1.99	1.65	1.42	1.24	1.10	0.99	0.90	0.82	0.76	0.71	0.66	0.62	0.58	0.55	0.52	0.49	0.47
200	3.98	3.31	2.84	2.48	2.21	1.99	1.80	1.65	1.53	1.42	1.32	1.24	1.17	1.10	1.04	0.99	0.94
300	5.97	4.97	4.26	3.73	3.31	2.98	2.71	2.48	2.29	2.13	1.99	1.86	1.75	1.65	1.57	1.49	1.42
400	7.96	6.63	5.68	4.97	4.42	3.98	3.61	3.31	3.06	2.84	2.65	2.48	2.34	2.21	2.09	1.99	1.89
500	9.95	8.29	7.10	6.21	5.52	4.97	4.52	4.14	3.82	3.55	3.31	3.10	2.92	2.76	2.61	2.48	2.36
600	11.94	9.95	8.52	7.46	6.63	5.97	5.42	4.97	4.59	4.26	3.98	3.73	3.51	3.31	3.14	2.98	2.84
700	13.93	11.6	9.95	8.7	7.73	6.96	6.33	5.8	5.35	4.97	4.64	4.35	4.09	3.86	3.66	3.48	3.31
800	15.92	13.26	11.37	9.95	8.84	7.96	7.23	6.63	6.12	5.68	5.3	4.97	4.68	4.42	4.18	3.98	3.79
900	17.91	14.92	12.79	11.19	9.95	8.95	8.14	7.46	6.88	6.39	5.97	5.59	5.26	4.97	4.71	4.47	4.26
1000	19.9	16.58	14.21	12.43	11.05	9.95	9.04	8.29	7.65	7.1	6.63	6.21	5.85	5.52	5.23	4.97	4.73
1100	21.89	18.24	15.63	13.68	12.16	10.94	9.95	9.12	8.41	7.81	7.29	6.84	6.43	6.08	5.76	5.47	5.21
1200	23.88	19.9	7.05	14.92	13.26	11.94	10.85	9.95	9.18	8.52	7.96	7.46	7.02	6.63	6.28	5.97	5.68
1300	25.87	21.55	18.47	16.16	14.37	12.93	11.75	10.77	9.95	9.23	8.62	8.08	7.60	7.18	6.80	6.46	6.15
1400	27.86	23.21	19.9	17.41	15.47	13.93	12.66	11.6	10.71	9.95	9.28	8.7	8.19	7.73	7.33	6.96	6.63
1500	29.85	24.87	21.32	18.65	16.58	14.92	13.56	12.43	11.48	10.66	9.95	9.32	8.77	8.29	7.85	7.46	7.1
1600	31.84	26.53	22.74	19.9	17.68	15.92	14.47	13.26	12.24	11.37	10.61	9.95	9.36	8.84	8.37	7.96	7.58
1700	33.83	28.19	24.16	21.14	18.79	16.91	15.37	14.09	13.01	12.08	11.27	10.57	9.95	9.39	8.9	8.45	8.05
1800	35.82	29.85	25.58	22.38	19.9	17.91	16.28	14.92	13.77	12.79	11.93	11.19	10.53	9.95	9.42	8.95	8.52
1900	37.81	31.5	27	23.63	21	18.9	17.18	15.75	14.54	13.5	12.6	11.81	11.12	10.5	9.95	9.45	9

ILOPROST CONVERSION TABLE

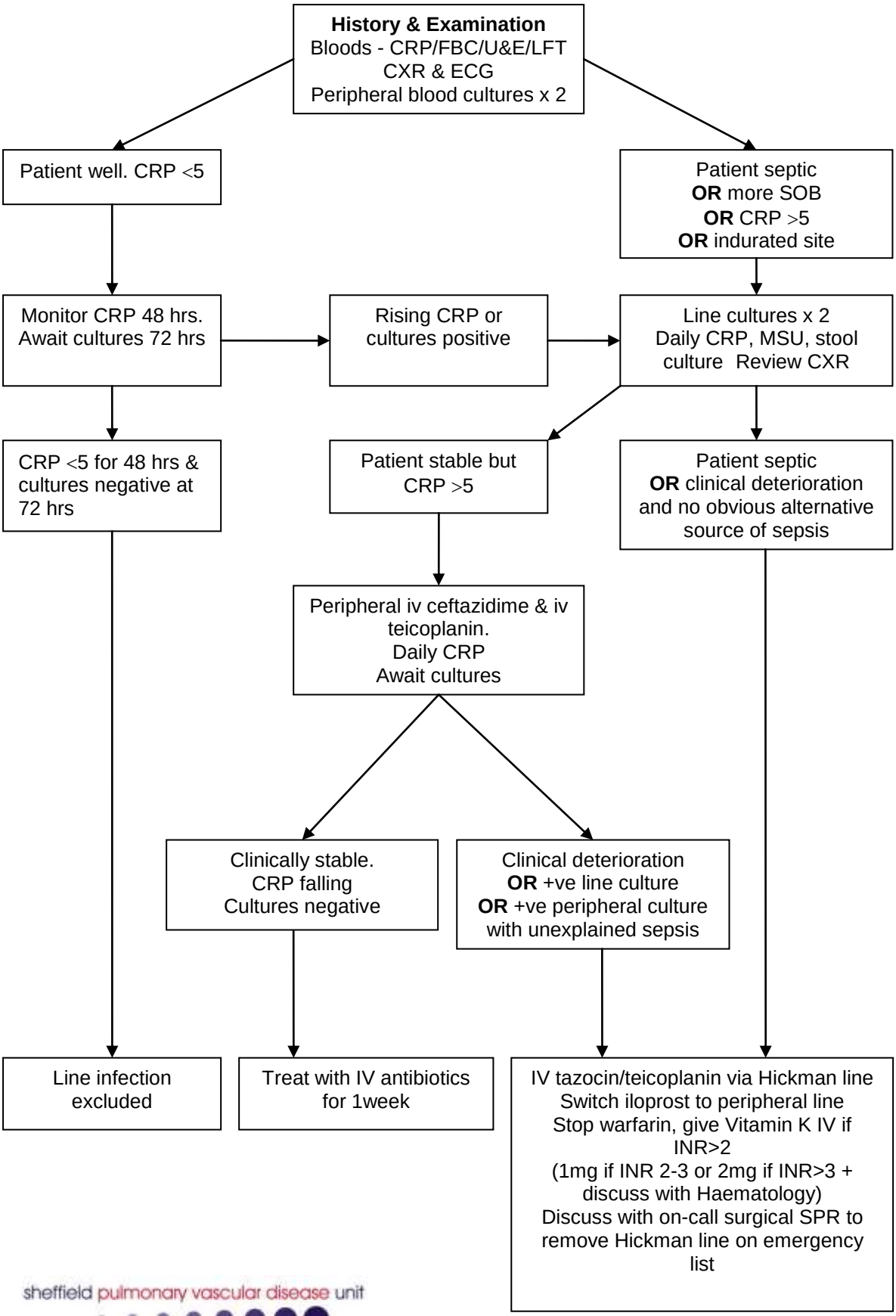
The infusion rate in Graseby pump is fixed at 2mm/hour, and Iloprost is diluted up to 19 mls normal saline:

Concentration (mcg) in a Graseby pump

100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57

Infusion rate (mls/hour) in a syringe pump (100 mcg Iloprost in 100 mls normal saline)
NB: You can double the concentration, i.e., 200mcg and half the rate

Sheffield screening protocol for Hickman Line infection in all patients admitted to hospital treated with intravenous prostaglandin therapy



sheffield pulmonary vascular disease unit
a nationally designated specialist centre

SHEFFIELD PULMONARY VASCULAR DISEASE UNIT
ANTICOAGULATION BRIDGING GUIDELINE
March 2012

Background

STH have changed the low molecular weight heparin (LMWH) of choice from enoxaparin (clexane) to dalteparin (fragmin). PVDU are in a unique position whereby the majority of patients travel from outside of Sheffield and the immediate vicinity and so the practicalities of arranging INR and anti-Xa checks and dalteparin prescription and administration are more difficult. Furthermore due to the relatively minor nature of the procedure (RHC or IVC filter) it is felt appropriate to recommence warfarin on "Day 0". For patients from Sheffield bridging should be performed via the anticoagulation clinic using their protocol for standard high-risk patients.

Patients requiring bridging

Group A: Standard Risk

- Previous VTE on long term anticoagulation
- CTEPH (but not if recent acute thrombus or critical stenosis)
- IVC Filter in situ
- Bileaflet aortic valve replacement with no other risk factors for stroke

Group B: High Risk patients who may be bridged on normal Dalteparin regime

- AF with previous stroke/TIA or rheumatic valvular heart disease
- Recent VTE (within 3 months)
- Antiphospholipid syndrome
- Recurrence of VTE while on anticoagulation (hence target INR 3-4)
- **CTEPH if recent clot or critical stenosis**

Group C: High Risk patients who require twice daily Dalteparin regime

- Metallic Mitral Valve
- Caged Ball or Tilting Disc aortic valve replacement
- Bileaflet aortic valve replacement with additional stroke risk factor

NB. All other patients would be classed as Low Risk and do not require bridging

Dalteparin Dosing

Group A: Standard Risk (CrCl >20)

- <45 kg 2,500 units od
- 45-100 kg 5,000 units od
- 101-150 kg 7,500 units od
- >150 kg 5,000 units bd

If CrCl <20 then dose is 2500 units for all weights

Group B: High Risk normal regime (CrCl ≥ 30)
Prescribe on VTE treatment chart

- <45 kg 7,500 units od
- 45-56 kg 10,000 units od
- 57-68 kg 12,500 units od
- 69-82 kg 15,000 units od
- 83-100 kg 18,000 units od
- 101-115 kg 10,000 units bd
- 116-140 kg 12,500 units bd
- >140 kg 15,000 units bd

Group C: High Risk twice daily regime (CrCl ≥30)
Prescribe on normal kardex and annotate reason for dosing on kardex

- <45 kg 5,000 units am, 2,500 units pm
- 46-65 kg 5,000 units bd
- 66-99 7,500 units bd
- 100-115 kg 10,000 units bd
- 116 -140 kg 12,5000 units bd
- >140 kg discuss dose with haematologist

Group B & C with renal impairment: High Risk CrCl 20-29*
Prescribe on VTE treatment chart

- <63 kg 5,000 units am, 2,500 units pm
- 63-80 kg 5,000 units bd
- 81-98 kg 7,500 units am, 5,000 units pm
- 99-116 kg 7,500 units bd
- 117-134 kg 10,000 units am, 7,500 units pm
- 135-152 kg 10,000 units bd

*For patients with CrCl 20-29 there is a concern regarding Dalteparin clearance. Trough anti-Xa levels are therefore needed at 24-30 hours post dose on admission. If trough anti-Xa level >0.2 discuss with haematologist.

PBVDU Bridging Policy Practicalities

Standard Risk (Normal target INR 2-3)

- Last dose warfarin Thursday
- Commence Dalteparin prophylactic dose Sunday pm
- Restart warfarin and prophylactic dose Dalteparin at 18:00 day of procedure

High Risk (Normal target INR 2-3)

- Last dose warfarin Thursday
- Commence Dalteparin therapeutic dose Sunday am if recent INR control good. If INR >3.5 within recent months then to start Dalteparin therapeutic dose Monday am.
- Last dose Dalteparin morning of day **before** procedure
- Restart warfarin and prophylactic dose Dalteparin at 18:00 day of procedure
- Restart treatment dose Dalteparin 08:00 day after procedure

High Risk (Normal target INR 3-4 – ie metallic valves or recurrent clot while on warfarin: RHC Wed if possible)

- Last dose warfarin Friday
- Admit Monday
- Commence Dalteparin therapeutic dose on once INR <2
- Last therapeutic dose Dalteparin at least 24 hrs **before** procedure
- Restart warfarin and prophylactic dose Dalteparin at 18:00 day of procedure
- Restart treatment dose Dalteparin 08:00 day after procedure

High Risk CrCl 20-29

- Last dose warfarin Thursday
- Commence Dalteparin therapeutic dose Sunday am if recent INR control good. If INR >3.5 within recent months then to start Dalteparin therapeutic dose Monday am.
- Last dose Dalteparin morning of day **before** procedure
- Check anti-Xa levels at 24-30 hours following last dose on admission
- Restart warfarin and prophylactic dose Dalteparin at 18:00 day of procedure
- If trough ant-Xa levels <0.2 then can be discharged using the same Dalteparin dosing as on admission
- If trough anti-Xa levels >0.2 then d/w haematology regarding dosing/requirement to stay in

ANTICOAGULATION FLOW-CHART FOR PATIENTS RECEIVING LONG TERM ANTICOAGULATION