



**Nurse Practitioner  
Advanced Heart Failure & Cardiac Transplant Services (AHFCTS)  
Clinical Protocol VAD drive-line exit site infection**

| <b>Scope</b>   |  | <b>Outcomes</b>  |
|--|--|--|
| <b>Nurse Practitioner<br/>Advanced Heart Failure &amp; Cardiac Transplant Services (NP AHFCTS)</b> | <ul style="list-style-type: none"> <li>• Clinical signs and symptoms of drive-line infection in a patient with Ventricular Assist Device (VAD)</li> </ul>  | Identify patients suitable for NP AHFCTS Clinical Practice Guideline (CPG)   |
| <b>Medical Practitioner +/-Nurse Practitioner</b>  | <ul style="list-style-type: none"> <li>• History / symptoms consistent with systemic infection associated with VAD drive-line exit site.</li> </ul>  | Identify patients not suitable for NP AHFCTS CPG and redirect NP management to usual AHFCTS care with NP AHFCTS as part of the service team. |
| <b>Initial Assessment &amp; Interventions</b>  |  | <b>Outcomes</b>  |
| <b>Primary survey assessment</b>   | <ul style="list-style-type: none"> <li>• Cardiac Assessment</li> <li>• Respiratory assessment</li> <li>• Abdominal assessment</li> </ul>   | Abnormal primary survey identified → exit CPG  |
| <b>History</b>   | <ul style="list-style-type: none"> <li>• Current complaint</li> <li>• Past medical &amp; surgical history</li> <li>• Medications</li> <li>• Allergies</li> </ul>   | Exclusion criteria identified → exit CPG   |
| <b>Focused clinical assessment</b>   | <ul style="list-style-type: none"> <li>• Appearance</li> <li>• Observations – heart rate and rhythm, blood pressure and temperature</li> <li>• Cardiac assessment of heart sounds &amp; JVP</li> <li>• Respiratory assessment; respiratory rate, oxygen saturations, breath sounds, adventitious sounds</li> <li>• Abdominal assessment</li> <li>• Drive-line exit site</li> </ul> | Determine need for further investigations including swabs, pathology and radiology. Identify patients for drive line infection CPG           |



| <b>Working diagnosis and Investigations</b>                                     |   | <b>Outcomes</b>   |
|---|---|---|
| <b>Investigations-<br/>Microscopy, culture<br/>and susceptibility</b>           | <ul style="list-style-type: none"> <li>• Drive-line exit site swab required if;<br/>Purulent discharge<br/>Localised pain<br/>Presence of erythema, induration or swelling at site</li> </ul>   | Identification of causative organism  |
| <b>Pathology</b>  | <ul style="list-style-type: none"> <li>• Blood tests – FBP, U &amp; Es, LFTs, ESR, CRP,</li> <li>• Blood cultures if temperature &gt;38°C</li> <li>• Consider necessity for IV access and insert cannulae if required</li> </ul>  | Assessment of indicators for infection.<br>Assessment of need for intravenous access                        |
| <b>Imaging – Abdominal<br/>CT</b>   | <ul style="list-style-type: none"> <li>• Imaging required if ;<br/>Pain over VAD site<br/>Evidence of systemic sepsis – risk of conduit endocarditis<br/>Presence of erythema, induration swelling or redness over drive line site in abdomen</li> </ul>  | Evaluation and assessment of potential VAD pocket collection  |
| <b>Interpretation of results (diagnostic features) and management decisions</b> |   | <b>Outcomes</b>   |
| <b>No signs or symptoms of infection identified</b>                             | <ul style="list-style-type: none"> <li>• NP AHFCTS review with view to discharge</li> <li>• Patient education</li> <li>• Immobilisation belt</li> <li>• Follow-up appointment in VAD clinic if required</li> </ul>  | Patient discharged  |
| <b>Localised infection at drive-line exit site identified</b>                   | <ul style="list-style-type: none"> <li>• NP AHFCTS review with view to discharge</li> <li>• Patient education</li> <li>• Topical dressing review</li> <li>• Pain relief as required</li> <li>• Oral antibiotic therapy</li> <li>• Follow up appointment in AHFCTS clinic within 5-7 days</li> </ul> | Patient discharge & clinic review arranged.<br>Carer competent in aseptic technique and dressing management |
| <b>Systemic sepsis identified</b>   | <ul style="list-style-type: none"> <li>• Medical practitioner +/- nurse practitioner AHFCTS review and hospital admission</li> <li>• Medical practitioner +/- nurse practitioner AHFCTS review empirical parenteral antibiotic therapy</li> <li>• Patient education</li> </ul>                      | Patient admission to cardiology ward  |



|   | <ul style="list-style-type: none"> <li>• Topical dressing application</li> </ul>   |   |
|---|--|---|
| <b>Patient Discharge Education</b>              |  | <b>Outcomes</b>   |
| <b>Follow up appointments</b>                   | <ul style="list-style-type: none"> <li>• Verbal instructions from NP AHFCTS</li> <li>• Outpatient appointment in AHFCTS clinic</li> </ul>  | Patient understands problem, treatment, follow up and is safe for discharge home              |
| <b>Medication instructions</b>                  | <ul style="list-style-type: none"> <li>• Verbal instructions from NP AHFCTS</li> <li>• Provision medication education and medication list.</li> </ul>  | Patient understands problem, treatment, follow up and is safe for discharge home              |
| <b>Topical drive-line dressing instructions</b> | <ul style="list-style-type: none"> <li>• Demonstration of aseptic technique</li> <li>• Provision of education on asepsis</li> <li>• Management of drive-line infection including signs &amp; symptoms</li> </ul>   | Patient understands problem, treatment, preventative measures, and is safe for discharge home |
| <b>Education</b>                                | <ul style="list-style-type: none"> <li>• Potential complications associated with VAD drive-line infection</li> <li>• Immobility</li> <li>• Diet</li> <li>• Reporting structure</li> </ul>  | Ensure patient understands the problem, treatment and preventative measures                   |
| <b>Safety assessment</b>                        | <ul style="list-style-type: none"> <li>• Assess home support</li> <li>• Consider referrals to silver chain nursing service or hospital in the home (HITH) for dressings</li> </ul>   | Patient and carer understand follow up management and is safe for discharge home              |
| <b>Other Referrals</b>                          | <ul style="list-style-type: none"> <li>• Referrals by medical practitioner ± nurse practitioner as indicated to;</li> <li>• Microbiology (medical practitioner). A Nurse Practitioner should contact a Clinical Microbiologist or Infectious Diseases Physician for approval to use a restricted antimicrobial, even when that restricted antimicrobial appears in an approved protocol</li> <li>• Infectious diseases (medical practitioner)</li> </ul> | Patient understands the problem, treatment, follow up and is safe for discharge home          |



|   |   |  |
|---|---|--|
|   | <ul style="list-style-type: none"> <li>• Dietician</li> <li>• Occupational therapy</li> <li>• Silver chain nursing service</li> <li>• HITH</li> </ul>   |  |
| <b>Certificates</b>   | <ul style="list-style-type: none"> <li>• Absence from work certificates</li> </ul>  | Appropriate documentation completed  |
| <b>Letters</b>  | <ul style="list-style-type: none"> <li>• Local medical practitioner letter</li> </ul>   | Ensures continuity of care and referral to health care team  |
| <b>Medications</b>  |   | <b>Outcomes</b>  |
| All medication will be stored, labelled and dispensed in accordance with hospital policy and relevant legislation |   |  |
| <b>Analgesia</b>  | <b>Paracetamol 500mg:</b> 1 or 2 tablets 4-6-hourly, not exceeding 8 tablets in 24 hrs  | Patients given medication appropriate to allergies, current medications and past medical history<br><br>Analgesia requirements determined by ongoing assessment of pain and adequate analgesia provided<br><br>Patients with excessive pain or pain unrelieved by analgesia needs review by medical practitioner |
|   | <b>Panadeine 500mg – to be used in conjunction with paracetamol if still in pain</b> 1- 2 tablets 4-6-hourly, not exceeding 8 tablets in 24 hrs<br>paracetamol 500mg + codeine 8mg (Panadeine)  |  |
|   |   |  |
| <b>Antibiotic therapy for treatment of drive-line exit site infection.</b>  | <u>1.Empiric first line therapy:</u><br><u>1.1Mild infection</u><br>Flucloxacillin 1g oral 6-hourly for 7-14 days OR Dicloxacillin 1g oral 6-hourly for 7-14 days<br><br><u>Penicillin hypersensitivity:</u> <ul style="list-style-type: none"> <li>• Non-immediate penicillin</li> </ul> | Patients given medication appropriate to allergies, current medications and past medical history   |



|   |   |  |
|---|---|--|
| <p><b><u>Gram +ve cocci</u></b> (eg. <i>Staphylococcus aureus</i>, beta-haemolytic <i>Streptococcus</i> spp)</p><br><p><b><u>Gram negative rods</u></b> (eg <i>E. coli</i>, <i>Acinetobacter</i> spp, <i>Pseudomonas</i> spp) and other organisms</p> | <p>hypersensitivity - Cephalexin 500mg -1g oral 6-hourly for 7 days</p> <ul style="list-style-type: none"> <li>• Immediate penicillin hypersensitivity -Consult Clinical Microbiologist / Infectious Diseases Physician prior to commencing treatment</li> </ul> <p><u>1.2 Moderate to severe infection:</u><br/>Flucloxacillin 2g IV 6-hourly for 7-14 days or Dicloxacillin 2g IV 6-hourly for 7-14days<br/>Plus</p> <p>Gentamicin; initial dose 4 to 6mg/kg depending on renal function. (Avoid in patients &gt;75 years old or in creatinine clearance &lt;20L/min, adjust subsequent doses according to therapeutic drug monitoring).</p> <p><b>Refer to Pharmacy fact file for recommendations for gentamicin dosing</b></p> <p><u>Penicillin hypersensitivity:</u><br/>Non-immediate penicillin hypersensitivity<br/>Cephazolin 2g IV 8-hourly<br/>For 5-7 days</p> <p>Immediate penicillin hypersensitivity – Consult with Clinical Microbiologist / Infectious Diseases Physician -</p> <p>2. Definitive Therapy</p> <p>2.1 Methicillin – susceptible <i>S. aureus</i>, beta haemolytic streptococci</p> <p>2.1.1 mild infection: as above</p> <p>2.1.2 moderate to severe infection: as above</p> <p>2.2 Methicillin-resistant <i>S. aureus</i></p> | <p>Parenteral therapy (if required) is initiated in a timely fashion in consultation with cardiologist (+/- Clinical Microbiologist / Infectious Diseases Physician).</p> <p>Signs and symptoms of infection have resolved at drive-line exit site. Visual evidence of granulation of skin into percutaneous drive-line at exit site.</p> <p>Protocol for gentamicin dosing maintained in accordance with RPH guidelines</p> |
|---|---|--|



|  |   |  |
|--|---|--|
|  | (MRSA) – Discuss therapy with Clinical Microbiologist / Infectious Diseases Physician.<br>Discuss with medical officer AHFCTS & Consultant Clinical Microbiologist / Infectious Diseases Physician regarding significance of result, and antimicrobial therapy  |  |
| <b>Intervention</b>  |   | <b>Outcome</b>   |
| <b>Topical drive-line dressing</b>   | Hypersaline (20%) solution – dressing repeated 6 hourly, period variable<br><br>Aquacel Silver – Dressing repeated daily, duration of treatment variable<br><br>MediHoney™ Dressing repeated daily, duration of treatment variable<br><br>Note: The use of Aquacel Silver and MediHoney™ is currently unsupported by evidence based research. | Patients will be treated with topical dressings in accordance with patients' allergies and manufacturer's recommendations.<br><br>Resolution of drive-line site infection, visual evidence of granulation of skin into percutaneous drive-line at exit site. |
| <b>Clinical audit evaluation strategies</b>  |   |  |
| <b>Unscheduled clinic visit</b>  | AHFCTS attendance register and NP AHFCTS clinical log   |  |
| <b>Missed problem</b>  | AHFCTS weekly meeting   |  |
| <b>References</b>  |   |  |
| <ol style="list-style-type: none"> <li>1. AMH (2007) <i>Australian Medicines Handbook</i>. Adelaide: AMH Pty LTD</li> <li>2. Advanced Heart Failure and Transplant Service (2004). <i>Heart Failure and Transplant manual</i>. Unpublished manuscript, Perth.</li> <li>3. Baddour, L.M (2001) Long term suppressive antimicrobial therapy for intravascular device related infections. <i>American Journal of Medical Science</i>. 322(4), 209-12.</li> <li>4. Department of Health Western Australia (2003). <i>Western Australian Nurse Practitioner Business Case and Clinical Protocol Templates</i>. Perth: Department of Health Western Australia</li> </ol> |   |  |



5. Doggrell, S.A., Brown, L. (2002) Present and future pharmacotherapy for heart failure. *Expert Opinion Pharmacotherapy*. 3(7), 915-30.
6. El-Banayosy, A., Arusoglu, L., Kizner, L., Fey, O., Minami, K., Korfer, R. (2000) Complications of circulatory assist. *Perfusion*. 15, 327-331
7. Holman, W.L., Rayburn, B., Griffin, D.M., Foley, B., Benza, R., Bourge, R. et al. (2003) Infection in ventricular assist devices: prevention and treatment. *Annals of Thoracic Surgery*, 75, 287-288.
8. Holman, W.L., Soon, J.P., Long, J.W., et al. (2004) Infection in Permanent Circulatory Support; Experience from the REMATCH Trial. *Journal Heart and Lung Transplant* 23, 1359-65
9. Krum, H., Tonkin, A.T., Currie, R., Djundjek, R., Johnston, C.I. (2001) Chronic heart failure in Australian general practice. *Medical Journal Australia*.174:43-444
10. Molan, P. (2001) Honey as a topical antibacterial agent for treatment of infected wounds. Retrieved May, 17, 2007 from <http://www.worldwidewounds.com/2001/november/Molan/honey-as-topical-agent.html>
11. Morgan, J.A., Oz, M.C. (2003) Cost effectiveness of left ventricular assist devices. *Expert Review of Pharmaco-economics and Outcomes Research*. 3: 427-432
12. O'Driscoll, G. (2000). Chronic heart failure: A guide for practical management. *Australian Family Physician*, 29(5), 1-5.
13. Rose, E. et al (1999) The REMATCH trial: rationale, design and end points. *Annals of Thoracic Surgery*. 67, 723-730
14. Simon, D., Fischer, S., Gossman, A., et al., (2005) Left ventricular assist device-related infection: Treatment and outcome. *Clinical Infectious Diseases* 40, 1108-1115
15. Sinha, P., Chen, J.M., Flannery, M., Scully, B.E., Oz, M.C., Edwards, N.M. (2000) Infections during left ventricular assist device support do not affect post transplant outcomes *Circulation* 102(3),194-196
16. Thoratec Laboratories (2003). *Heartmate VE LVAS Patient Management Manual*. Unpublished manuscript, Pleasanton, USA.
17. Walter, E.P., Connell, J.M., Adelowo, A., et al. (2007) *Journal Heart and Lung Transplant* 26, 219-39
18. Weitkemper, H., El-Banayosy, A., Arusoglu, L. Sarnowski, P. Korfer, R. (2003) Mechanical Circulatory Support: Reality and dreams experience of a single centre. *Journal of the American Society of Extra-Corporeal Technology*. 36, 169-173.



| <b>Authorship and endorsement</b>  |  |
|--|--|
| <p><b>This CPG was written by:</b></p> <p>Clare Wood<br/>Nurse Practitioner AHFCTS<br/>Royal Perth Hospital</p> <p>Helen Hayes<br/>Nurse Practitioner AHFCTS<br/>Royal Perth Hospital</p> <p>Niki Parle<br/>Nurse Practitioner AHFCTS<br/>Royal Perth Hospital</p> | <p><b>This CPG has been reviewed and is endorsed by:</b></p> <p>Professor Gerry O’Driscoll<br/>Medical Head of AHFCTS<br/>Division of Critical Care</p> <p>Dr Lawrence Dembo<br/>Cardiologist<br/>AHFCTS<br/>Royal Perth Hospital</p> <p>Mr Robert Larbalestier<br/>Surgical Head of AHFCTS<br/>Royal Perth Hospital</p> <p>Dr Greg Van Schie<br/>Division of Imaging Services<br/>Royal Perth Hospital</p> <p>Mr Barry Jenkins<br/>Chief Pharmacist<br/>Royal Perth Hospital</p> <p>Dr Keryn Christiansen<br/>Microbiologist<br/>Royal Perth Hospital</p> |
| <b>Key to terms</b>  | <b>Appendices</b>  |
| <p><b>NP AHFCTS-</b> Nurse Practitioner Advanced Heart Failure &amp; Cardiac Transplant Service<br/><b>CPG-</b> Clinical Practice Guideline</p>  |  |
| <p><b>Written:</b> January 2007<br/><b>Reviewed:</b> N/A</p>   | <p><b>Review date:</b> March 2008</p>  |