CLINICAL PATHOLOGY GUIDELINES (CPath) Program

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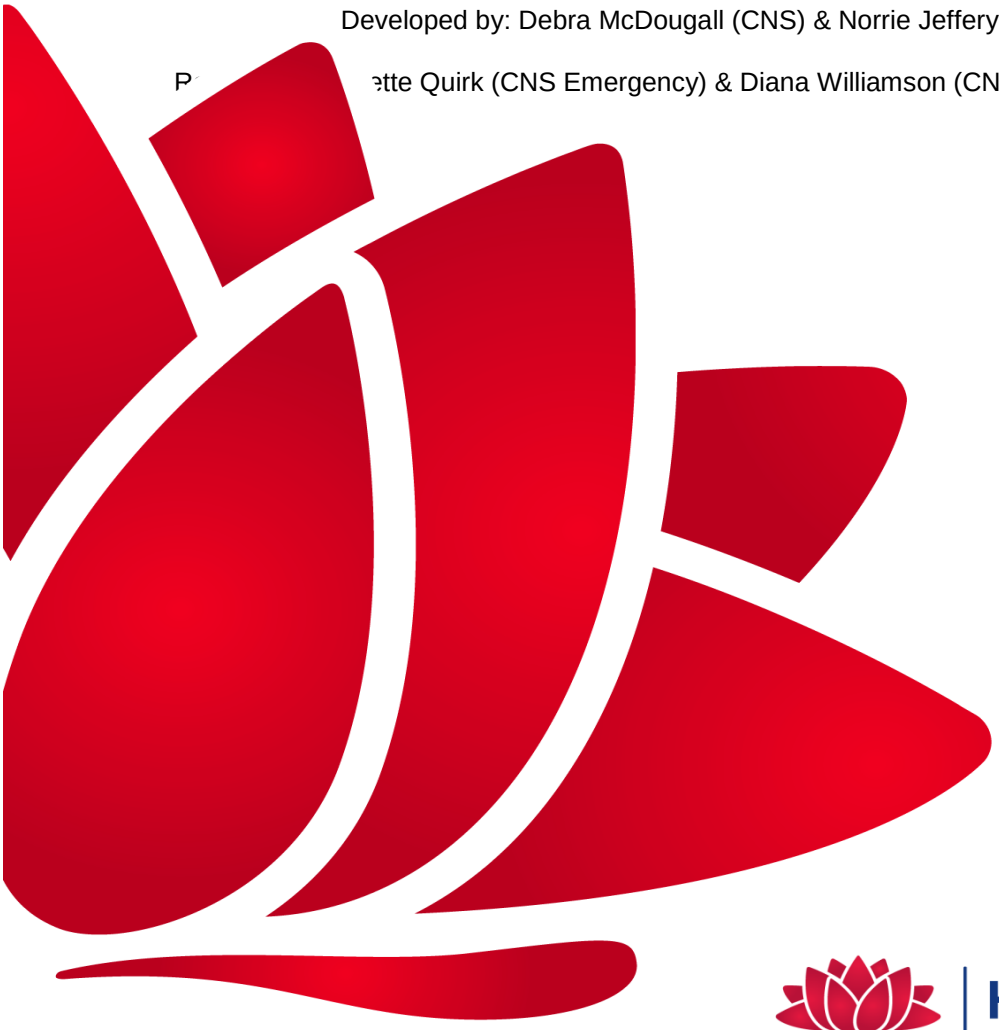

Health
Hunter New England
Local Health District

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Introduction

The motivation behind Clinical Pathology Initiatives (CPath) is strongly centred on the desire to assist in the continuing improvement of the service provided to patients within the Emergency Department (ED). Improvement of Key Performance Indicators (KPIs) has been greatly influenced by the implementation of CIN, NIX, NIA and improving staff specialist FTE. Early access to clinical treatments and diagnostic investigations lead to early patient disposition.

ED staff are committed to improving the quality and timeliness of care. Active attention to the patient flow within the ED is required at all times as it directly impacts on the efficiency of the clinical environment and the ability to deliver clinical care. The aim of CPath is to assist in the diagnostic process.

All clinicians working in the ED are committed to teamwork and take a holistic and multidisciplinary approach to patient care. Nursing staff would contribute to patient flow by ordering pathology based on specific guidelines. Junior ED medical staff would also follow the same guidelines improving standardisation of pathology ordering. The earlier pathology results are available the sooner patient disposition decisions can be made.

Objectives

- Improve service by initiating pathology earlier for specified presenting problems/symptoms.
- Increase efficiency by providing a safe framework and guidelines for junior medical and accredited nursing staff on expected pathology ordering for specified medical conditions and symptoms.
- There is an expectation that pathology costs would reduce.
- Improve quality of care by early diagnosis and treatment interventions.
- Improvement of turnaround time to admission/discharge (disposition).
- Assist the ED in achievement of definitive care as quickly as possible for patients who present.
- Enhance clinician and patient satisfaction and reduce stress and conflict
- Apply best practice for emergency presentations.

At present Clinical Initiatives Nurses (CIN) and Advanced Clinical Nurses (ACN's) are inserting IVC and collecting pathology, which is contributing to the improvement of benchmarking in the ED. At present nurses are required to

find medical staff to sign the form. Formalising the process will save valuable time for both nursing and medical staff. It would allow senior nursing staff and junior medical staff to be accredited in pathology ordering based on pre-agreed rules.

Formal Education

1. A learning package will be supplied and studied by the participant with expectations of self –directed learning supporting adult learning principles.
2. A one hour written open book exam on project guidelines and pathology to be completed and submitted to the nurse educators for marking .

Evaluation of Project

1. Evaluation of pathology initiated by nursing staff (will need to flag request forms **(Red C-path stamp).**

2. Total cost of the pathology initiated by nursing staff and medical staff.

3. Comparison of test costs with previous financial years

4. Additional tests required.

Inclusion Criteria

- Category 3, 4 and 5 patients
- Category 2 patients whilst waiting immediate medical intervention
- Patients in the waiting room, ambulance bay and ER
- Specified presentations within approved guidelines
- Patients over 14 yrs

Exclusion Criteria

- Children under 14yrs.
- Category 1 patients according to the ATS *and/or with*
- Haemodynamic instability i.e Systolic Blood Pressure < 90mmHg or > 200mmHg or and/or Heart Rate < 50bpm or > 120. ➡ ***All these patients should be referred immediately to a Senior Medical Officer.***
- Patients presenting with pathology attended prior to arrival.
- Ambiguous or complicated presentations
- Patients presenting with conditions outside the approved guidelines.
- Admitted patients

Nursing Competency Requirements

- Advance assessment skills
- Current certificate in IV Cannulation and Venipuncture
- At the recommendation of the department / facility manager

Nursing Accreditation

- Completion with at least 80% in exam

Issues

To avoid duplication of pathology tests ordered there needs to be clear communication to the medical staff looking after the patient. Documentation in the medical record completed and to include tests ordered and time seen.

The purpose of these guidelines is to formalise emergency nursing practice by appropriately educated and experienced Registered Nurses. Implementation of Advanced Clinical Nursing practice allows for the early implementation of appropriate clinical care without the need to wait for medical officer initial assessment. The medical officer will continue to be involved in patient management until discharge and will see patients as soon as possible. Nurses will not be able to initiate pathology outside the approved guidelines set out by medical staff. Junior medical staff will need to seek advice from more senior medical staff to order pathology outside the guidelines.

Pathology should be a shared responsibility and basic nursing care should take priority over any other tasks.

Time factor is a key issue for the CIN and ACN. Nursing staff need to be aware that they still have a responsibility to complete information on the green nursing assessment and observation form. The CIN/ACN commences the form, but at times does not have the time to fill out all pertinent data.

It is strongly recommended that the IV cannulation package and ***An Introduction to Vascular Access*** (*available on the intranet)* is reviewed prior to assessment as it is assumed knowledge for inclusion to the CPath group.

Reasons for Blood collection

- To confirm diagnosis
- To exclude diagnosis
- To monitor therapy
- To monitor medication level
- To establish diagnosis
- To screen for or detect a disease
- To stage a disease

Types of laboratory specimens

Blood samples for certain tests must meet special requirements. Some tests require whole blood whilst others require components such as plasma, serum or cells

- **SERUM**: consists of plasma minus fibrinogen. Serum is obtained by drawing blood in a non- additive tube and allowing it to coagulate.

- **PLASMA**: consists of stable components of blood minus the cells. Is obtained by using an anticoagulant to prevent the blood from clotting.

- **WHOLE BLOOD**: some tests e.g. Full blood count

- **MID STREAM URINE COLLECTION:** Refer to HNELDH Clinical Procedure Policy for Urine Specimen Collection.

Order of the Draw

How blood is drawn is itself critical to the care of the patient. The collector plays a fundamental and critical role in the accuracy of test results, not only for identifying the patient, but also for the integrity of the sample. Haemolysis affects testing, if a tube isn't filled with adequate blood to anticoagulant ratio, that specimen is not suitable for testing.

If the tubes are filled in the wrong order, it can cause mistakes that are invisible to the person performing the test. When drawing with a vacutainer, tubes generally fill from top to bottom, thus contaminating the needle that pierced the stopper with the blood/additive mixture. Trace amounts could be carried over to the next tube creating the likelihood of test inaccuracy. These inaccurate results could lead to a mistake in diagnosis or medication.

The blood tubes used are either additive or non-additive. Blood collection tubes must be drawn in a specific order to avoid cross-contamination of additives between tubes. The recommended order of draw is:

- Blood Culture Tubes
- Venous Blood Gas (venous blood gas syringe)
- Plain Serum Glass Tubes (**Red Top**/**Pink Top**)
- Sodium Citrate Tubes (**Light Blue Top**)
- Heparin Tubes/Heparin Gel Separator Tubes (**Green Tops**)
- EDTA Tubes (**Purple Tops**)
- Glucose Preservative Tubes (**Gray Tops**)

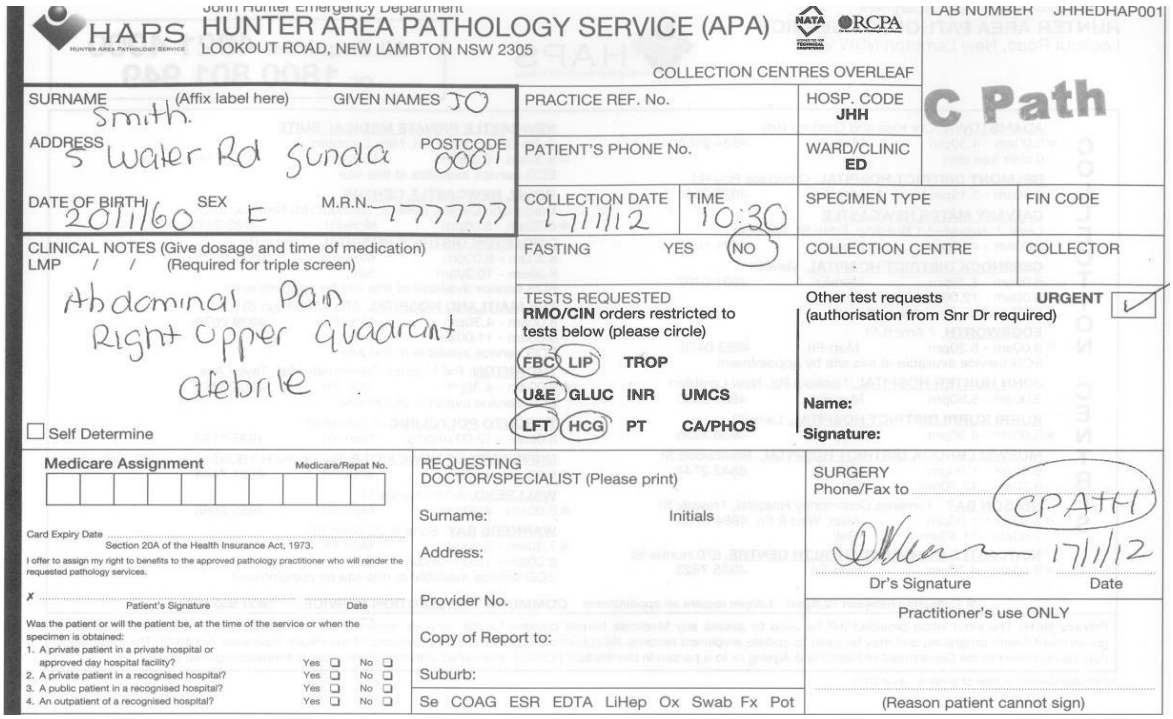
NOTE: Tubes with additives must be thoroughly mixed. Erroneous test results may be obtained when the blood is not thoroughly mixed with the additive. Gently invert the tube to mix.

Documentation Requirements

A requisition form must accompany each sample submitted to the laboratory. This requisition form must contain the proper information in order to process the specimen. The essential elements of the HAPS request form are:

- Patient's surname, first name, and middle initial.
- Patient's Medical Record Number (MRN).
- Patient's date of birth and sex.
- Name of nurse/MO requesting and signature
- CPATH identified
- Source of specimen.
- Date and time of collection.
- Initials of phlebotomist.
- Indicating the test(s) requested.

An example of a HAPS request form with the essential elements is shown below



HAPS
John Hunter Emergency Department
HUNTER AREA PATHOLOGY SERVICE (APA)
LOOKOUT ROAD, NEW LAMBTON NSW 2305
NATA RCPA
COLLECTION CENTRES OVERLEAF
LAB NUMBER JHHEDHAP001
C Path

SURNAME Smith (Affix label here) GIVEN NAMES JO
ADDRESS 5 Water Rd Sunda POSTCODE 0081
DATE OF BIRTH 20/1/60 SEX F M.R.N. 777777

PRACTICE REF. No.
HOSP. CODE JHH
PATIENT'S PHONE No.
WARD/CLINIC ED
COLLECTION DATE 17/1/12 TIME 10:30
SPECIMEN TYPE
FIN CODE
FASTING YES (NO)
COLLECTION CENTRE
COLLECTOR

CLINICAL NOTES (Give dosage and time of medication)
LMP / / (Required for triple screen)
Abdominal Pain
Right Upper Quadrant
afebrile

TESTS REQUESTED
RMO/CIN orders restricted to tests below (please circle)
(FBC) (LIP) TROP
U&E GLUC INR UMCS
(LFT) (HCG) PT CA/PHOS

Other test requests (authorisation from Snr Dr required)
URGENT ✓
Name:
Signature:

☐ Self Determine

Medicare Assignment Medicare/Repat No.
Card Expiry Date
Section 20A of the Health Insurance Act, 1973.
I offer to assign my right to benefits to the approved pathology practitioner who will render the requested pathology services.
✗ Patient's Signature Date
Was the patient or will the patient be, at the time of the service or when the specimen is obtained:
1. A private patient in a private hospital or approved day hospital facility? Yes ☐ No ☐
2. A private patient in a recognised hospital? Yes ☐ No ☐
3. A public patient in a recognised hospital? Yes ☐ No ☐
4. An outpatient of a recognised hospital? Yes ☐ No ☐

REQUESTING DOCTOR/SPECIALIST (Please print)
Surname: Initials
Address:
Provider No.
Copy of Report to:
Suburb:
Se COAG ESR EDTA LiHep Ox Swab Fx Pot

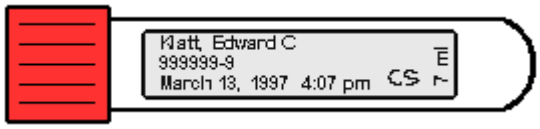
SURGERY
Phone/Fax to CPATH
Dr's Signature 17/1/12 Date
Practitioner's use ONLY
(Reason patient cannot sign)

Labelling the sample

A properly labelled sample is essential so that the results of the test match the patient. The key elements in labelling are:

- Patient's surname, first and middle.
- Patient's MRN.
- **NOTE**: Both of the above MUST match the same on the requisition form.
- Date, time and initials of the phlebotomist must be on the label of EACH tube.

An example of a simple requisition form with the essential elements is shown below:



Nursing Assessment & Interventions

To establish consistency and standardisation, all nursing assessment and intervention standing orders follow the recognised Airway, Breathing, Circulation and Disability (ABCD) approach. They are designed to include the expected nursing standard as well as points of definitive management and should be attended as the initial nursing assessment prior to any pathology being taken.

	Assessment	Intervention
Airway	▪ Assess patency	Maintain airway patency – use of airway adjuncts or maneouvers *If airway inadequate or compromised immediate medical attention is required*
Breathing	▪ Respiratory rate, rhythm, depth and effort ▪ Listen for breath/chest sounds ▪ Observe posture & behaviour ▪ Monitor SpO^2	Apply O^2 to maintain SpO^2 > 95% *If breathing inadequate or compromised immediate medical attention is required - consider assisted ventilation*
Circulation	▪ Capillary refill ▪ Skin colour & turgor ▪ Pulse rate, rhythm & strength ▪ Blood pressure +/- orthostatic ▪ Cardiac Monitor *(as indicated)*	IV cannulation / pathology If BP < 90mmmHg or > 200mmHg systolic ⇨ immediately notify MO *If circulation is inadequate or compromised immediate medical attention is required*
Disability	▪ GCS ▪ Pupil size and reaction	Monitor level of consciousness regularly *If significant abnormality detected i.e GCS < 13 ⇨ immediate medical attention is required*
Exposure	▪ Identify obvious injuries ▪ Temperature	*If significant abnormality detected immediate medical attention is required*
Vital Signs	Assess vital signs regularly according to patient acuity (*5 min - 1 hourly*): ▪ RR, HR, BP, T, SpO^2 ▪ GCS ▪ BSL	*If significant abnormality detected immediate medical attention is required*
History AMPLE	**A**llergies **M**edications **P**ast history **L**ast ate/drank **E**vents and Environment	Documentation of all history and events

Adapted from *NSW Rural Emergency Clinical Guidelines for Adults (2004)*

Nursing Management Flow Chart

Triage Nurse
Patient with designated presenting problem, is triaged and meets criteria for Advanced Nursing Practice

NO

Category 2 – ***Immediate medical officer review***

Interventions may be attended whilst awaiting review

YES
Category 3, 4 or 5

- Introduce self to patient
- Informs patient of their role – RN and/or CIN
- Takes patient to assessment area
- Conducts initial assessment
    1) Primary assessment - ABCD & Vital Signs
    2) Identifies chief complaint and associated symptoms
    3) History - current / past
    4) Recognise and attend to analgesia requirements

Discuss the findings of the initial assessment with a medical officer prior to proceeding as complications identified are beyond scope of practice?

YES

MEDICAL OFFICER REVIEW

NO

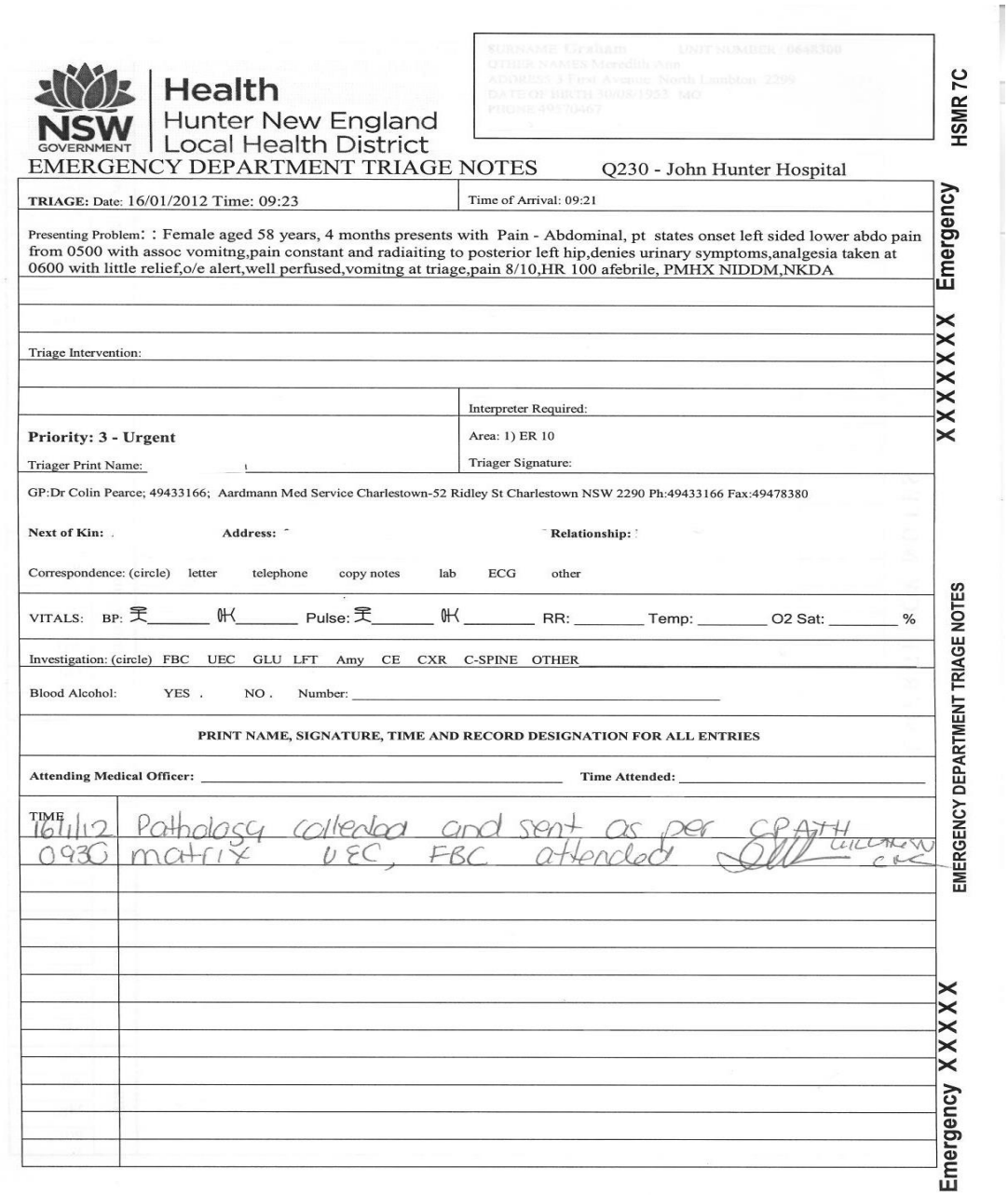
The management identified is to be conducted within a timeframe (*maximum 10-15 mins*) meeting the patient's needs whilst considering the assessment requirements of other patients waiting

- Ensures analgesia requirements are met as per standing orders
- Instigates a management plan as indicated within advanced practice skills
    - Pathology
    - Radiology
    - Attends to continued assessment
- Documents assessment, management and follow-up required
- Patient education - provides advice and information handouts as indicated

Specific Nursing Documentation

Ensuring that the treating Medical Officer can easily identify which pathology has been collected and sent to pathology is pertinent in expediting patient treatment times. Easy identification of blood tests attended, the time collected and sent to pathology allows the medical officer to be able to anticipate when results may be available. The nurse initiating the CPath pathology must document on the medical assessment form the following information.

- Date
- Time
- Specific tests ordered
- Signature



NSW GOVERNMENT Health
Hunter New England
Local Health District

EMERGENCY DEPARTMENT TRIAGE NOTES Q230 - John Hunter Hospital

HSMR 7C

TRIAGE: Date: 16/01/2012 Time: 09:23 | Time of Arrival: 09:21

Presenting Problem: : Female aged 58 years, 4 months presents with Pain - Abdominal, pt states onset left sided lower abdo pain from 0500 with assoc vomitng,pain constant and radiaiting to posterior left hip,denies urinary symptoms,analgesia taken at 0600 with little relief,o/e alert,well perfused,vomitng at triage,pain 8/10,HR 100 afebrile, PMHX NIDDM,NKDA

Triage Intervention:

Interpreter Required:

Priority: 3 - Urgent

Area: 1) ER 10

Triager Print Name:

Triager Signature:

Emergency XXXXXXX

GP:Dr Colin Pearce; 49433166; Aardmann Med Service Charlestown-52 Ridley St Charlestown NSW 2290 Ph:49433166 Fax:49478380

Next of Kin: **Address:** **Relationship:**

Correspondence: (circle) letter telephone copy notes lab ECG other

VITALS: BP: 王_____ 休_____ Pulse: 王_____ 休_____ RR: _____ Temp: _____ O2 Sat: _____ %

Investigation: (circle) FBC UEC GLU LFT Amy CE CXR C-SPINE OTHER

Blood Alcohol: YES . NO . Number:

PRINT NAME, SIGNATURE, TIME AND RECORD DESIGNATION FOR ALL ENTRIES

Attending Medical Officer: **Time Attended:**

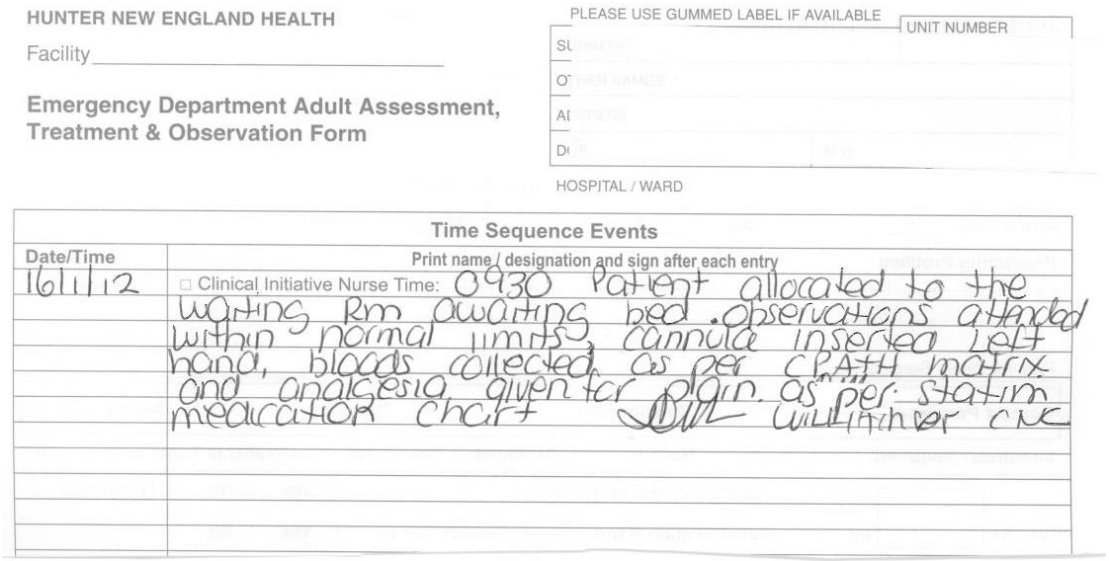
EMERGENCY DEPARTMENT TRIAGE NOTES

TIME	
16/1/12 0930	Pathology collected and sent as per CPATH matrix UEC, FBC attended

Emergency XXXXX

Nursing Assessment Form

Tick the box marked bloods on the form, In order to save double documentation this will be sufficient. Fill out other information as usual. Document the cannula observations, and any other pertinent information. It is far more important that the medical officer treating the patient be aware of the pathology collect and sent.



HUNTER NEW ENGLAND HEALTH

Facility _____

Emergency Department Adult Assessment, Treatment & Observation Form

PLEASE USE GUMMED LABEL IF AVAILABLE

UNIT NUMBER

SURNAME

OTHER NAMES

ADDRESS

DOB

HOSPITAL / WARD

Time Sequence Events

Date/Time	Print name / designation and sign after each entry
16/1/12	☐ Clinical Initiative Nurse Time: 0930 Patient allocated to the waiting Rm awaiting bed. observations attached within normal limits, cannula inserted left hand, bloods collected as per CPATH matrix and analgesia given for pain. as per stat im medication chart Will further CNE

Required Documentation Overview

- HAPS request form
- Specimen Samples
- Medical Notes
- Nursing assessment form
- Evaluation form

Always remember not all patients require pathology. Use your clinical judgement, if in doubt ASK a senior Doctor for advice. Pathology is a significant cost to the department and a desirable goal is to reduce costs associated with pathology not increase them.

Specific Laboratory Tests

The following pathology test included in the pathology matrix, outlined in Appendix 2 will be discussed on the next few pages.

- FBC
- UEC
- LFT
- Troponin
- Lipase v's amylase
- Coagulation studies
- INR
- Serum βHCG
- Venous Blood Gas -Lactate
- MSU

Full Blood Count (FBC)

A **FBC** is one of the most frequently ordered basic screening laboratory tests. FBC findings give valuable diagnostic information about the hematologic and other body systems. The FBC consists of a series of tests that determine number, variety, percentage, concentrations, and quality of blood cells:

White Blood cell counts (WBC) Leukocytes fight infection and are raised in infection and inflammation.

Differential white blood cell count (Diff): specific patterns of WBC and can be raised in bacterial infections.

Red blood cell count (RBC): red blood cells carry O_2 from lungs to blood tissues and CO_2 from tissue to lungs.

Hematocrit (Hct): measures RBC mass.

Haemoglobin (Hb): main component of RBCs and transports O_2 and CO_2.

Red blood cell indices: calculated values of size and Hb content of RBCs; important in anaemic evaluations

Platelet count: is a diagnostic test that determines the number of platelets in blood. Platelets, which are also called thrombocytes, are small disk-shaped blood cells produced in the bone marrow and involved in the process of blood clotting. There are normally between 150,000-450,000 platelets in each

microliter of blood. Low platelet counts or abnormally shaped platelets are associated with bleeding disorders. High platelet counts sometimes indicate disorders of the bone marrow.

The primary functions of a platelet count are to assist in the diagnosis of bleeding disorders and to monitor patients who are being treated for any disease involving bone marrow failure.

Urea, electrolytes and creatinine UEC

Urea: constitutes the final product of protein metabolism. The amount of excreted urea varies directly with dietary protein intake, increased excretion in fever, diabetes, and increased adrenal gland activity and dehydration.

Urea is increased in acute and chronic renal disease, in states characterised by decreased effective circulating blood volume with decreased renal perfusion eg dehydration and heart failure. Decreased urea is seen in high carbohydrate / low protein diets and severe liver damage.

Creatinine: Is a by-product in the breakdown of muscle resulting from energy metabolism. It is produced at a constant rate depending on the muscle mass of the person and is removed from the body by the kidneys. A disorder of kidney function reduces excretion of creatinine, resulting in increased blood creatinine levels. Thus, creatinine levels give an approximation of the glomerular filtration rate.

Electrolytes (ions) are critical for cellular reactions. Electrolytes provide the necessary inorganic chemicals for a variety of cellular functions (eg, nerve impulse transmission, muscular contraction, water balance).

Sodium is the most abundant cation (90% of the electrolyte fluid) and the chief base of the blood. Its primary functions in the body are to maintain osmotic pressure and acid-base balance chemically and to transmit nerve impulses. The body has a strong tendency to maintain a total base content, and only slight changes are found even under pathologic conditions. Determinations of plasma sodium levels detect changes in water balance rather than sodium balance. Sodium levels are used to determine electrolytes, acid-base balance, water balance, water intoxication, and dehydration.

Potassium is the principal electrolyte (cation) of intracellular fluid and the primary buffer within the cell itself. Ninety percent of potassium is concentrated within the cell. Damaged cells release potassium into the blood. Potassium plays an important role in nerve conduction, muscle function, acid-base balance, and osmotic pressure. Along with calcium and magnesium, potassium controls the rate and force of contraction of the heart and, thus, the cardiac output. This test evaluates changes in body potassium levels and diagnoses acid-base and water imbalances. Because a totally unsuspected

potassium imbalance can suddenly prove lethal, its development must be anticipated. Thus, it is important to check the potassium level in severe cases of Addison's disease, uremic coma, intestinal obstruction, and acute renal failure, GI loss in the administration of diuretics, steroid therapy, and cardiac patients on digitalis. Potassium levels should be monitored during treatment of acidosis, including ketoacidosis of diabetes mellitus.

Calcium: the bulk of the body's calcium is stored in the skeleton and teeth, which act as huge reservoirs for maintaining blood levels of calcium. About 50% of blood calcium is ionized; the rest is protein bound. Only ionised calcium can be used by the body in such vital processes as muscular contraction, cardiac function, transmission of nerve impulses, and blood clotting.

Phosphate is required for generation of bony tissue, with functions in the metabolism of glucose and lipids, in the maintenance of acid-base balance, and in the storage and transfer of energy from one site in the body to another. Phosphate levels are always evaluated in relation to calcium levels because there is an inverse relation between the two elements.

Magnesium in the body is concentrated (40%–60%) in the bone, 20% muscle, 30% within the cell itself, and 1% in the serum, and is required for the use of adenosine triphosphate (ADP) as a source of energy. It is therefore necessary for the action of numerous enzyme systems such as carbohydrate metabolism, protein synthesis, nucleic acid synthesis, and contraction of muscular tissue. Along with sodium, potassium, and calcium ions, magnesium also regulates neuromuscular irritability and the clotting mechanism. When there is decreased kidney function, greater amounts of magnesium are retained, resulting in increased blood serum levels. Magnesium measurement is used to evaluate renal function, electrolyte status, and evaluate magnesium metabolism.

Liver Function Tests

Liver function tests represent a broad range of normal functions performed by the liver. The diagnosis of liver disease depends upon a complete history, complete physical examination, and evaluation of liver function tests and further invasive and non-invasive tests. Inflammation of the hepatic cells results in elevation in the alanine aminotransferase (ALT), aspartate aminotransferase (AST) and possibly the bilirubin. Inflammation of the biliary tract cells results predominantly in an elevation of the alkaline phosphatase. In liver disease there are crossovers between purely biliary disease and hepatocellular disease.

Alanine Aminotransferase ALT is the enzyme produced within the cells of the liver. The level of ALT abnormality is increased in conditions where cells of the liver have been inflamed or undergone cell death. As the cells are damaged, the ALT leaks into the bloodstream leading to a rise in the serum levels. Any form of hepatic cell damage can result in an elevation in the ALT.

The ALT level may or may not correlate with the degree of cell death or inflammation. ALT is the most sensitive marker for liver cell damage.

Aspartate Aminotransferase AST also reflects damage to the hepatic cell. It is less specific for liver disease. It may be elevated and other conditions such as a myocardial infarct (heart attack). Although AST is not a specific for liver as the ALT, ratios between ALT and AST are useful to physicians in assessing the etiology of liver enzyme abnormalities

Alkaline phosphatase is an enzyme, which is associated with the biliary tract. It is not specific to the biliary tract. It is also found in bone and the placenta. Renal or intestinal damage can also cause the alkaline phosphatase to rise. If the alkaline phosphatase is elevated, biliary tract damage and inflammation should be considered. However, considering the above other etiologies must also be considered. Alkaline phosphatase may be elevated in primary biliary cirrhosis, alcoholic hepatitis, and gallstones in cholithiasis.

Bilirubin is a major breakdown product of haemoglobin. Haemoglobin is derived from red cells that have outlived their natural life and subsequently have been removed by the spleen. During splenic degradation of red blood cells, haemoglobin is separated out from iron and cell membrane components. Haemoglobin is transferred to the liver where it undergoes further metabolism in a process called conjugation. Conjugation allows haemoglobin to become more water-soluble. The water solubility of bilirubin allows the bilirubin to be excreted into bile. Bile then is used to digest food.

As the liver becomes irritated, the total bilirubin may rise. It is then important to understand the difference between total bilirubin, which has undergone conjugation (that is hepatic cell metabolism), and that portion of bilirubin which has not been metabolised. These two components are called total bilirubin and direct bilirubin. The direct bilirubin fraction is that portion of bilirubin that has undergone metabolism by the liver. When this fraction is elevated, the cause of elevated bilirubin (hyperbilirubinemia) is usually outside the liver. These types of causes are typically gallstones. If the direct bilirubin is low, while the total bilirubin is high, this reflects liver cell damage or bile duct damage within the liver itself.

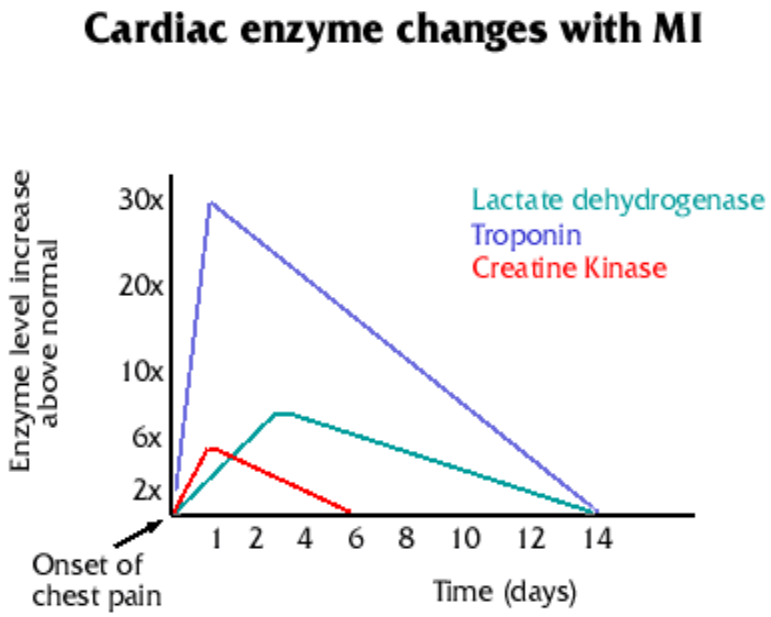
Albumin is the major protein present within the blood. Albumin is synthesized by the liver. As such, it represents a major synthetic protein and is a marker for the livers ability to synthesize proteins. Albumin is only one of many proteins that are synthesized by the liver. However, since it is easy to measure, it represents a reliable and inexpensive laboratory test for physicians to assess the degree of liver damage present in the in any particular patient. When the liver has been chronically damaged, the albumin may be low. This would indicate that the synthetic function of the liver has been markedly diminished.

Troponin Normal - value <0.1

The troponin complex is a protein that plays an important role in the regulation of skeletal and cardiac muscle contraction. It consists of three subunits, troponin I (TnI), troponin T (TnT) and troponin C (TnC). TnT and TnI present differently in cardiac muscles than in skeletal muscles. Only one tissue-specific isoform of TnI is specific for cardiac muscle tissue (cTnI). cTnI is expressed only in the myocardium. For sometime now the cardiac form of TnI has been recognised as being a reliable marker of cardiac tissue injury. Troponin reaches peak concentrations in approximately 8 to 28 hours, and remains elevated for 3 to 10 days following an Acute Myocardial Infarction (AMI).

According to the Clinical Chemistry Troponin ordering protocol, Troponin may be analysed:

- In the absence of chest pain, if the suspected infarction has occurred more than 8 hours previously.
- If there has been a history of chest pain of more than 8 hours duration.



Amylase and Lipase

Amylase and lipase testing are usually done together in the presence of abdominal pain, epigastric tenderness, nausea, and vomiting. **Amylase** is an enzyme that changes starch to sugar, produced in the salivary glands and pancreas; intestines, and skeletal muscle. **Lipase** is a glycoprotein that, in the presence of bile salts changes fats to fatty acids and glycerol. Lipase appears in the blood following pancreatic damage at the same time amylase appears (or slightly later) but remains elevated much longer than amylase (7 to 10 days).

You will notice amylase has not been included on the pathology matrix and the reason for this is that around 25% of patients with acute pancreatitis have a normal amylase. Lipase is more sensitive and specific than amylase. Lipase is also present longer after an episode of pancreatitis. It is rare for amylase to be raised without lipase if the diagnosis is pancreatitis.

Coagulation Studies

The prime functions of the coagulation mechanism are to protect the integrity of the blood vessels while maintaining the fluid state of blood. Coagulation tests are generally done for patients with bleeding disorders, vascular injury or trauma, or coagulopathies.

The most common causes of haemorrhage are thrombocytopenia (platelet deficiency) and other acquired coagulation disorders, including liver disease, uraemia, and anticoagulant administration. Together, they account for most hemorrhagic problems. Clotting disorders are divided into two classes: those caused by impaired coagulation and those caused by hypercoagulability.

Hypercoagulability States

Two general forms of hypercoagulability exist: hyperactivity of the platelet system, which results in arterial thrombosis, and accelerated activity of the clotting system, which results in venous thrombosis. Hypercoagulability refers to an unnatural tendency toward thrombosis. The thrombus is the actual insoluble mass (fibrin or platelets) present in the bloodstream or chambers of the heart. Conditions and classifications associated with hypercoagulability include the following:

Platelet Abnormalities: These conditions are associated with arteriosclerosis, diabetes mellitus, increased blood lipids or cholesterol levels, increased platelet levels, and smoking. Arterial thrombosis may be related to blood flow disturbances, vessel wall changes.

Clotting System Abnormalities: These are associated with congestive heart failure, immobility, artificial surfaces (e.g., artificial heart valves), damaged vasculature, use of oral contraceptives, pregnancy and the postpartum state, and the post-surgical state.

Venous Thrombosis; This can be related to stasis of blood flow, to coagulation alterations, or to increases in pro coagulation factors or decreases in anticoagulation factors

Disorders of Haemostasis

Thrombocytopenia (platelet count <150 × 103/mm3) is caused by decreased production of platelets, increased use or destruction of platelets, or hypersplenism. Contributing factors include bone marrow disease,

autoimmune diseases, DIC, bacterial or viral infection, chemotherapy, therapy radiation, multiple transfusions, and certain drugs.

Acquired Coagulation Abnormalities

These are associated with several disease states and are much more common than inherited deficiencies.

Circulatory anticoagulant activity may be evident in the presence of antifactor VIII, rheumatoid arthritis, the immediate postpartum period, SLE, or multiple myeloma.

Vitamin D deficiency may be caused by oral anticoagulants, biliary obstruction and malabsorption syndrome, or intestinal sterilisation by antibiotic therapy.

Disseminated Intravascular Coagulation (DIC) causes continuous production of thrombin, which, in turn, consumes the other clotting factors and results in uncontrolled bleeding.

Primary fibrinolysis is the situation whereby isolated activation of the fibrinolytic mechanism occurs without prior coagulation activity, as in streptokinase therapy, severe liver disease, prostate cancer, or, more rarely, electroshock.

NB: Most coagulation factors are manufactured within the liver. Consequently, in liver disease, the extent of coagulation abnormalities is directly proportional to the severity of the liver disease.

All patients with haemorrhagic or thrombotic tendencies, or undergoing coagulation studies, should be observed closely for possible bleeding emergencies. A comprehensive history and physical examination should be done.

INR

Warfarin is an anticoagulant medication, used to prevent or slow down the formation of thrombus that may result in an embolism. Warfarin blocks the action of vitamin K by preventing the production of coagulation or clotting factors. The anticoagulant effect of warfarin is measured in terms of the prothombin time which is the time taken for blood clotting to occur. The blood clotting ability of a sample of blood is measured in terms of the International Normalised Ratio **(INR).** Warfarin is used in conditions where there is an increased risk of blood clots forming such as in people with rheumatic heart disease or with artificial (prosthetic) heart valves. It is also used in the prevention or treatment of conditions such as pulmonary embolism. Normal INR ranges from 2.0 to 4.5.

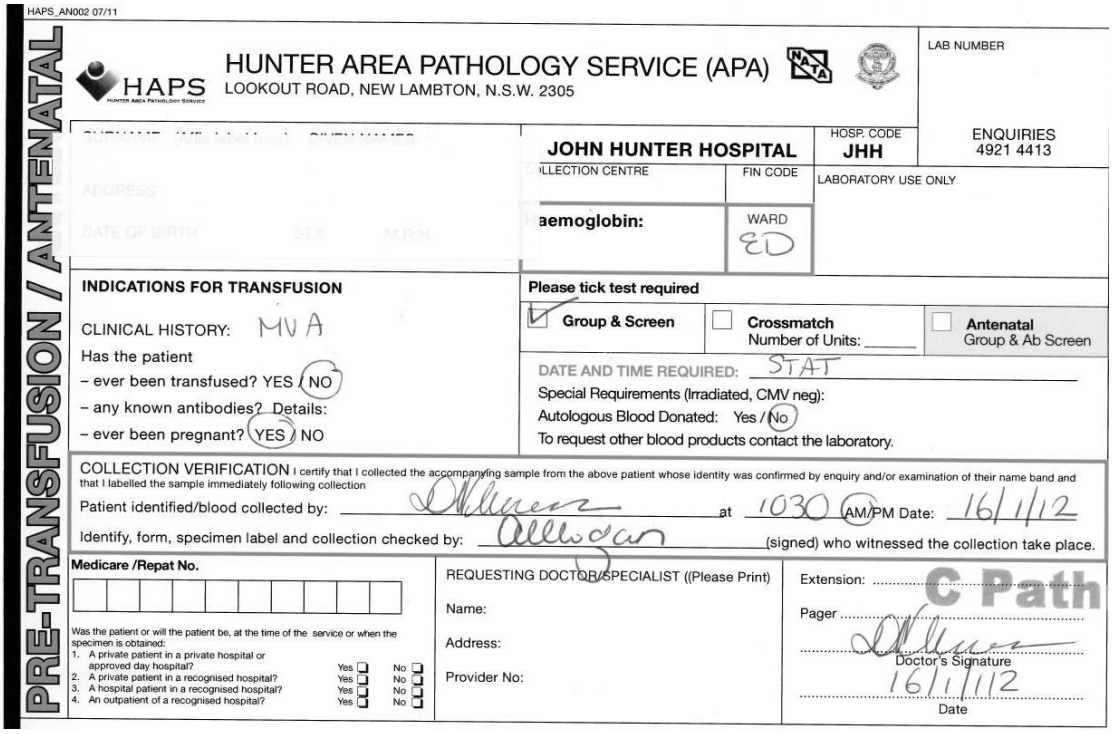
NB: Coagulation tubes must be filled to the correct level; tubes with incorrect amount will not be processed by pathology resulting in the need to recollect the specimen.

BhCG

Human Chorionic Gonadotropin, (hCG), production begins approximately 8-10 days after conception when the embryo starts to burrow itself into the lining of the uterus. It is this hormone that is measured by early pregnancy tests and if present, will return a positive result. A hCG beta blood test can detect a pregnancy from as early as 10 days after fertilization. As the embryo grows, the level of hCG rises and, as a general rule, hCG beta numbers should double every 36 to 48 hours. A dramatic decrease in the levels may indicate a miscarriage has occurred or is possible, whereas a level that lingers or falls well below the normal range may indicate an ectopic pregnancy. hCG beta levels can also be used to identify a multiple pregnancy. hCG levels will top out by the end of the first trimester. It is preferable that pregnant patients with pain and PV bleeding have a serum beta hCG prior to ultrasound.

Group and Save

A group and save must be attended for patients that may require transfusing with blood or blood products. The form must be completed as shown below and the details must be checked with 2 staff members and with the patient that the specimen has been taken from.



HAPS_AN002 07/11

PRE-TRANSFUSION / ANTENATAL

HAPS
HUNTER AREA PATHOLOGY SERVICE (APA)
LOOKOUT ROAD, NEW LAMBTON, N.S.W. 2305

LAB NUMBER

JOHN HUNTER HOSPITAL | HOSP. CODE JHH | ENQUIRIES 4921 4413

LLECTION CENTRE | FIN CODE | LABORATORY USE ONLY

aemoglobin: | WARD ED

INDICATIONS FOR TRANSFUSION

CLINICAL HISTORY: MV A

Has the patient
- ever been transfused? YES / NO
- any known antibodies? Details:
- ever been pregnant? YES / NO

Please tick test required

☑ Group & Screen ☐ Crossmatch Number of Units: ____ ☐ Antenatal Group & Ab Screen

DATE AND TIME REQUIRED: STAT

Special Requirements (Irradiated, CMV neg):

Autologous Blood Donated: Yes / No

To request other blood products contact the laboratory.

COLLECTION VERIFICATION I certify that I collected the accompanying sample from the above patient whose identity was confirmed by enquiry and/or examination of their name band and that I labelled the sample immediately following collection

Patient identified/blood collected by: _____ at 1030 AM/PM Date: 16/1/12

Identify, form, specimen label and collection checked by: _____ (signed) who witnessed the collection take place.

Medicare /Repat No.

Was the patient or will the patient be, at the time of the service or when the specimen is obtained:
1. A private patient in a private hospital or approved day hospital? Yes ☐ No ☐
2. A private patient in a recognised hospital? Yes ☐ No ☐
3. A hospital patient in a recognised hospital? Yes ☐ No ☐
4. An outpatient of a recognised hospital? Yes ☐ No ☐

REQUESTING DOCTOR/SPECIALIST ((Please Print)

Name:

Address:

Provider No:

Extension: C Path

Pager .....

Doctor's Signature

16/1/12

Date

Blood Cultures

Blood Culture Collection is not part of CPATH and a senior doctor needs to authorise this request.

A blood culture is a test to determine if microorganisms such as bacteria, mycobacteria, or fungus are present in the blood. A sample of blood is put in a special laboratory preparation and is incubated in a controlled environment for 1 to 7 days. In this test it is important that the blood sample does not become contaminated by organisms on the skin or equipment used in preparing the test. A strict sterile technique is followed to obtain and prepare the specimen. The culture is examined for the presence of microorganisms over several days. If organisms are present, further culturing may take place to identify the organisms. A Gram stain may also be done to classify the organism so that antibiotic therapy can be started before final culture results are available.

Blood cultures collected must be 1 x aerobic and 1 x anaerobic bottles plus a red top for baseline serum.

Need to mark pathology request form with 'Baseline serum store please'. This is the only time a serum tube for holding is sent.

Key Messages from the Blood Culture Sampling Guideline

1. Take two sets (4 bottles) of blood cultures as a minimum for each sepsis episode

2. Fill each bottle with 10mL blood, total 40mL; do not over or under fill. For adult patients overfilling results in an inadequate dilution leading to inadequate neutralisation. Smaller volumes decrease sensitivity.

3. The 2 sets must be obtained from 2 different peripheral veins (in the same timeframe)

4. Clean the skin with 70% alcohol and then with chlorhexidine gluconate and 70% alcohol (reduces skin contamination of blood cultures), allow to dry and

Do not take blood cultures from a pre-existing central, peripheral or arterial line
If sampling is required from a pre-existing site this must be specifically discussed with the Consultant responsible for the care of the patient and the site of collection noted on the request form
One blood culture set may be drawn from a freshly inserted and unused IV cannula when inserted under aseptic technique

obtain the sample in an aseptic manner

N.B. Samples ideally should be drawn before starting antibiotic treatment.

Venous Blood Gas Lactate

Hyperlactatemia is typically present in patients with severe sepsis or septic shock secondary to anaerobic metabolism due to hypoperfusion and tissue hypoxia. Obtaining serum lactate is essential to identifying tissue hypoperfusion in patients who have clinical signs of sepsis or high risk patients for sepsis.

Lactate is a product of anaerobic metabolism, and is basically the normal end point of the anaerobic breakdown of glucose in the tissues. Lactic acidosis results from an increase in blood lactate levels, in the setting of decreased tissue oxygenation, lactic acid is produced as the anaerobic cycle is utilised for energy production. With a persistent oxygen deficit and overwhelming of the body's buffer system lactic acidosis ensues. This occurs when tissue oxygenation is inadequate to meet metabolic demands as a result of either hypoperfusion or hypoxia.

Lactate is cleared from the blood, primarily by the liver, with the kidneys and skeletal muscles to a lesser extent. Lactic acidosis is typically associated with tissue hypoperfsion and states of circulatory failure. Cardiopulmonary failure, sepsis, trauma, thiamine deficiency, side effects of drugs and toxins, oncologic pathology, reduced hepatic clearance, profound dehydration and various acquired and congenital diseases can lead to lactic acidosis. Treatment of lactic acidosis requires identification of the primary illness and appropriately directed therapy.

The CPATH matrix advocates the use of a venous blood gas and a lactate result with the commencement of a sepsis pathway. This is attended for all presentations to the emergency department in which the temperature is < 35.5 or > 38.5 or patients who present with DKA or pulmonary oedema.

There are result variations in the collection of a venous blood gas as opposed to aterial blood gases . These differences are tabled below :

Arterial Blood Gas

Assay	Normal Range
pH	7.35-7.45
PaCO2	35-45 mmHg
PaO2	80-100 mmHg
O2 Sat	95-99 %
CO	0-1.5 %
Base Excess	+ 2%
CO2 Content	21-27
HCO3	20-26 meq/L

Mixed Venous

Assay	Normal Range
pH	7.32-7.36
PvCO2	46 mmHg
PvO2	40 mmHg
SvO2	60-80%

Abdominal Assessment

Pain that arises from various abdominal pathologic processes may localise to different areas of the abdomen. A complaint-specific history and physical examination should be performed before a differential diagnosis is formulated or testing is performed. Below are some of the possible causes of abdominal pain presentations to the ED.

Right upper quadrant
Gall bladder- biliary colic
Cholecystitis
Hepatitis, alcoholic or infective
Pneumonia
Rare-liver tumour or abscess

Epigastric pain
Gastris or gastric duodenal ulcer
Pancreatitis
Heart attack
Ruptured aortic aneurysm

Loin pain both sides of the spine Lumber area
Urinary tract infection
Renal colic

Upper left quadrant
Pneumonia
Pancreatitis
Ruptured spleen

Umbilicale region
Irreducible/ strangulated hernia
Peri-umbilical hernia
Ruptured aneurysm

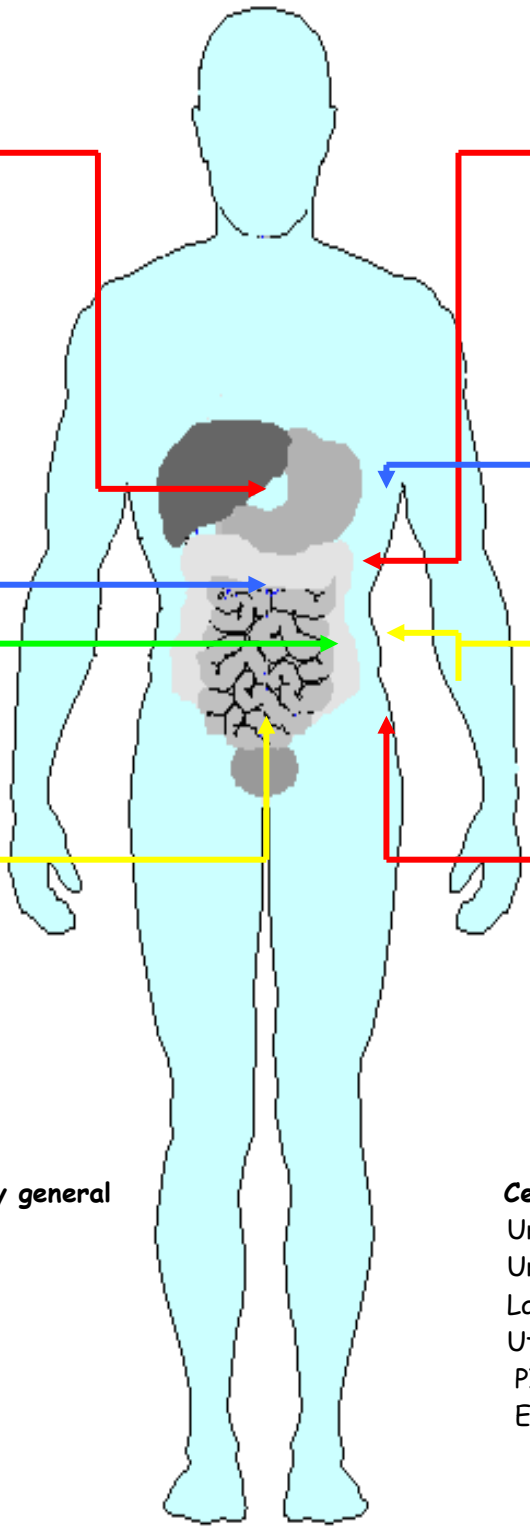
Loin pain-both sides usually lumber
Urinary tract infection
Renal colic

Lower abdominal pain ileac region pain Right side- appendicitis
Ectopic pregnancy
Ovarian cyst
PID
Irreducible or strangulated hernia

Lower abdominal usually ileac regions
Left side - diverticulitis
Ectopic pregnancy
Ovarian cyst
PID
Irreducible or strangulated hernia

Other causes less localises- usually general
Gastroenteritis
Small gut obstruction
Inflammatory bowel disease
Early appendicitis

Central
Urinary tract infection
Urine retention
Large bowel obstruction
Uterine fibroid complicatio
PID
Ectopic pregnancy



PARASYMPATHETIC NERVOUS SYSTEM

1. Upper Quadrant or Epigastric Pain

This protocol is to be implemented for patients who present with right upper, epigastric or left upper quadrant pain.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

Pain to right upper, epigastric or left upper quadrant of abdomen
Localised tenderness to right upper, epigastric or left upper quadrant of abdomen

Optional Markers

Radiation of pain into back
Previous history of gallstones
Onset of pain after eating
Excessive belching
Nausea/ vomiting

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Rebound tenderness and guarding

(NB: Interventions may be attended whilst waiting review).

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***Upper Quadrant/ Epigastric:*** FBC, EUC, LFT's & Lipase, Quantitative βHCG if +ve urine βHCG
	▪ Temperature	***Fever:*** Blood Cultures if temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); Base Serum for Hold Tube, VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Send MSU if positive for nitrates and/or leucocytes Urine βHCG if female of child bearing age

2. Flank / Loin Pain

This protocol is to be implemented for patients who present to the ED with suspected flank/loin pain.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Afebrile
History of recent onset of loin pain
Intractable pain in loin/flank region

Optional Markers

Pale
Clammy
Radiation of pain into the groin
Nausea/ vomiting
Dysuria
Dark/ blood coloured urine
Urinalysis positive for blood

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Consideration of alternative diagnosis of abdominal aortic aneurysm
(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***Flank / Loin:*** FBC & EUC
	▪ Temperature	***Fever:*** Blood Cultures if temp ≤ 35.5 or ≥ 38.5°C; (must be ordered by a senior doctor) Base Serum for Hold Tube & VBG lacate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Send MSU if positive for nitrates and/or leucocytes Urine βHCG if female of child bearing age

3. Lower Quadrant Pain

This protocol is to be implemented for patients who present with right lower quadrant abdominal pain.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

Pain to lower quadrant of abdomen (left, right or umbilical)
Localised tenderness to lower quadrant of abdomen

Optional Markers

Fever
Vomiting/nausea/anorexia
Lethargy
Pale

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Rebound tenderness and guarding

Pregnancy ≥ 6 weeks

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***Lower Quadrant:*** FBC & EUC. Quantitative βHCG if +ve urine βHCG
	▪ Temperature	***Fever:*** Blood Cultures if temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); Base Serum for Hold Tube & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Send MSU if positive for nitrates and/or leucocytes Urine βHCG if female of child bearing age.

4. Urinary Retention/Pyelonephritis

This protocol is to be implemented for patients who present with urinary retention with the mandatory markers below.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

Lower abdominal pain
Urgency to pass urine
Inability to void

Optional Markers

Clots in urine
Fever

Exclusions ⇨ *Refer all exclusions to Senior Medical Officer immediately*

Recent urological surgery
Past history of difficult catheterisation
Recent history of uro-genital trauma

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC & EUC
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU (if possible prior to catheterisation)	Ward Test urine Send MSU if positive for nitrates and/or leucocytes – notify medical officer Urine βHCG if female of child bearing age

5. 1st Trimester PV Bleeding

This protocol is to be implemented for patients who present with suspected 1st trimester vaginal bleeding.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

Moderate PV loss, more than usual menstrual period
Moderate soaking of pads
< 12 weeks gestation

Optional Markers

Positive urine or serum βHCG
Abdominal cramping
Presence of clots
Back pain/ cramping

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Haemodynamically unstable – heavy or gushing bleeding with or without clots
Suspicion of ectopic pregnancy
Referred pain – shoulder tip or diaphragmatic pain
Pregnant women in the 2nd and 3rd trimester

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, & Group and Hold. Quantitative βHCG, if +ve urine βHCG
	▪ Urinalysis / MSU	Ward test urine &urine βHCG Send MSU if positive for nitrates and/or leucocytes

6. Hip Injury or Fractures for OT Over 35 years

This protocol is to be implemented for patients who present with a suspected orthopaedic injury to the hip following a fall over 35 years of age.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

History of fall
Pain to hip / pelvic region
Unable to weight bear
Shortening and/or rotation of leg on injured side

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Under 35 years with no significant history
Where the mechanism of injury is consistent with trauma protocol activation

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC & Group and Hold
	▪ Urinalysis / MSU	Ward test urine Send MSU if positive for nitrates and/or leucocytes

7.Seizures / Postictal

This protocol is to be implemented for patients who present with a history of a seizure, or postictal following a seizure.

***All mandatory markers are necessary to implement this standing order*.**

Mandatory Markers

Convulsion lasting less than 15 minutes
Ceased fitting
GCS of 13 or more

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Status epilepticus
GCS < 13
Fever
(NB: Interventions maybe commencd whilst waiting or during review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***1st Convulsion:*** FBC, EUC, BSL, Calcium, Phosphate & Magnesium (CMP) ***Recurrent Seizures:*** FBC & Serum Hold Tube for anticonvulsant drug levels
	▪ Temperature	***Fever:*** Blood Cultures if temp. ≤ 35.5 or ≥ 38.5 (must be ordered by a senior doctor) & Base Serum for Hold Tube, VBG lactate (**Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Ward Test Urine Send MSU if positive for nitrates and/or leucocytes

Note:
Anticonvulsant therapeutic drug levels are available for:

- *Phenytoin*
- *Sodium Valproate*
- *Carbamazepine*

7. Shortness of Breath with a History of Asthma

This protocol is to be implemented for patients who present with shortness of breath and a history of asthma.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

History of asthma
Increased shortness of breath
Mild or moderate asthma symptoms

Optional Markers

Speaking in sentences or phrases
Mild to moderate use of accessory muscles
Absent to audible wheeze
Absent to moderate sternal retraction
Heart rate 100-120bpm

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Physical exhaustion
Confused, drowsy or agitated
Speaking in single words or unable to speak
Peripheral to central cyanosis
Marked use of accessory muscles
Marked sternal retraction
Status asthmaticus

(NB: Interventions maybe commenced whilst waiting review)

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***Moderate – Severe Asthma Requiring Admission:*** FBC & EUC
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

8. Shortness of Breath with a history of Chronic Airway Limitation (CAL)

This protocol is to be implemented for patients who present with shortness of breath with a history of chronic airways limitation.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

History of chronic airways limitation
Increased shortness of breath

Optional Markers

Audible wheeze
Speaking in sentences or phrases
Fever

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Physical exhaustion
Confused, drowsy or agitated
Speaking in single words or unable to speak

Peripheral to central cyanosis

Marked use of accessory muscles

(NB: Interventions maybe commenced whilst waiting review)

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC & EUC
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

Note:

- *Never deny oxygen in the acute stage of presentation*
- *Mental status is an important indicator of both worsening hypoxia and hypercapnia*
- *Be aware of signs of hypercapnia, that is, decreasing LOC, bounding pulse and warm dilated peripheries*

10.Shortness of Breath - History of Cardiac Disease.

This protocol is to be implemented for patients who present with chest pain, and/or shortness of breath with a background of cardiac disease.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers
Sudden onset of shortness of breath Difficulty breathing History of cardiac disease Audible respiratory crepitations
Optional Markers
Pale Clammy Speaking in sentences or phrases Fever

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***
Confused, drowsy or agitated
Speaking in single words or unable to speak
Peripheral to central cyanosis
Marked use of accessory muscles
(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's & Troponin if pain > 8 hours Coags if on Warfarin Venous Gas
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

9. Chest Pain – likely to be cardiac in nature

This protocol is to be implemented for patients who presents with chest pain likely to be of cardiac / ischaemic in nature.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers
Pre-cordial chest pain or discomfort Retrosternal chest pain or discomfort
Optional Markers
Back, neck and/or arm pain Epigastric pain Chest tightness Dyspnoea Pale Clammy
Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***
Haemodynamically unstable ECG changes Cardiac Arrhythmias

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's & Troponin if pain > 8 hours Coags if on Warfarin
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(commence Sepsis Pathway)**

10. Chest Pain – Non Cardiac

This protocol is to be implemented for patients who presents with chest pain considered likely to be non-cardiac or non-ischaemic in nature.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Pleuritic chest pain

Optional Markers

Shortness of breath
Back / upper quadrant pain
Cough / cold symptoms
Recent history of travel or prolonged bed rest
History of calf pain and/ or swelling
Fever

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Haemodynamically unstable
ECG changes
History of trauma

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	***Pulmonary Embolism*:** FBC, EUC, LFT's, Coags & Troponin if pain > 8 hours ***Epigastric / Upper Quadrant:*** FBC, EUC, LFT's & Lipase
	▪ Temperature	***Fever:*** Blood Cultures if temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); Base Serum for Hold Tube & VBG lactate **(Commence Sepsis Pathway)**

11. Shortness of Breath with possible Pneumonia

This protocol is to be implemented for patients who present with potential pneumonia according to the mandatory markers established below.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Persistent cough, or history of same
Fever, or history of same
Shortness of breath, or
Referred by local medical officer with possible pneumonia

Optional Markers

Chest tightness
Back pain
Pale
Clammy
Fever

Exclusions ⇨ Refer all exclusions to Senior Medical Officer immediately

Confused, drowsy or agitated

Speaking in single words or unable to speak

SaO2 > 93 % RA

Peripheral to central cyanosis

Marked use of accessory muscles

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC & EUC
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

12.Fever for Investigation

This protocol is to be implemented for patients who present with fever of > 24 hours.
All mandatory markers are necessary to implement this standing order.

Mandatory Markers

History of fever greater than 24 hours
Referred by local medical officer with fever for investigation

Optional Markers

Fatigue/ malaise
Myalgia/ joint pain
Headache
Nausea/ vomiting/ anorexia
Shortness of breath
Rash
Chills/ night sweats
Dark and/ or offensive urine
History of recent dental procedure, heart valve disease or replacement, permanent vascular devices (i.e. portacaths) & IVDU. (Think possible Endocarditis).

Exclusions ⇨ Refer all exclusions to Senior Medical Officer immediately

History of fever less than a 24 hour period
Non blanching rash
Individual who presents or represent within 24 hours of having blood test attended
Haemodynamicallly unstable

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC & LFT's
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Ward Test Urine Send MSU if positive for nitrates and/or leucocytes

Sepsis

The basis of sepsis is the presence of infection associated with a systemic inflammatory response that results in physiologic changes that occur at the capillary endothelial level. Knowing when a localised infection becomes systemic is often difficult as no standard criterion exists for the diagnosis of endothelial dysfunction, and patients with sepsis may not initially be hypotensive or shocked.

Systemic hypoperfusion and global tissue hypoxia precedes hypotension in severe sepsis and septic shock.
Global tissue hypoxia reults from:

5. Inflammatory cascade leading to cardiovascular insufficiency;
6. Increased metabolic demands;
7. Increased oxygen extraction;
8. Mitochondria defects and/ or cytopathic hypoxia.

Systemic inflammatory response syndrome (SIRS) is a term that was developed in an attempt to describe the clinical manifestations that result from the systemic response to infection. Meeting SIRS criteria is considered as having at least 2 of the following 4 clinical parameters abnormal:

- Body temperature > 38º C or < 36 º C
- Heart rate > 90 bpm
- Respiratory rate > 20
- Peripheral leukocyte count (WBC >12 or WBC < 4).

Sepsis is a disease seen most frequently in elderly persons and especially those with comorbid conditions that predispose infection (i.e diabetes, any immunocompromising disease, cancer on chemotherapeutic drugs, congenital heart disease (i.e rheumatic fever), cardiomyopathy, renal & liver disease, chronic illnesses with long term steroid use & patients with permanent indwelling devices).

15.Sepsis

This protocol and commencement of the Adult Sepsis Pathway is to be implemented for patients with suspected sepsis.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Refer to Sepsis Pathway

Optional Markers

Head and Neck Infections – Severe headache, neck stiffness, altered mental state, earache, sore throat, cervical or submandibular lymphadenopathy.
Chest and pulmonary infections – Cough (especiallly productive), pleuritic chest pain, SOB
Abdominal and GI infections – Abdominal pain, nausea, vomiting, diarrhoea
Pelvic and genitourinary infections – Pelvic or flank pain, vaginal or urethral discharge, dysuria, frequency, urgency, haematuria
Cellulitis, bone and soft tissue infections – Localised pain, swelling, erythema, rash, skin ulcerations and oedema
History of recent surgery, open wounds, dental procedures

Exclusions ⇨ Refer all exclusions to Senior Medical Officer immediately

Refer to Sepsis Pathway (Patient with severe sepsis).

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	*Intervention*
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC & LFT's
	▪ Temperature	**Fever:** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Ward Test Urine Send MSU if positive for nitrates and/or leucocytes

16.Gastrointestinal Haemorrhage (GIH)

This protocol is to be implemented for patients who present with suspected gastrointestinal haemorrhage.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Sudden or gradual onset GIH,
Sudden onset of haematemasis
Sudden or gradual onset of PR bleeding
History of black tarry stools
Unexplained new anaemia

Optional Markers

Pale
Syncope
History of alcohol abuse
On anticoagulant therapy

Exclusions ⇨ ***Refer all exclusions to Senior Medical Officer immediately***

Actively bleeding
Haemodynamically unstable
Decreased LOC

(NB: Interventions maybe commenced whilst waiting review)

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's, Coags & Group and Save
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

17. Syncope / Collapse > 35 years

This protocol is to be implemented for patients who present following a syncope or collapse.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

History of loss of consciousness
Dizziness / light-headedness
GCS of 15

Exclusions ⇨ ***Refer to appropriate guideline and/or Senior Medical Officer immediately***

Symptoms of TIA or stroke
Epilepsy
GCS < 13
Cardiac arrhythmia
Haemodynamically unstable

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's & Quantitative βHCG if +ve urine βHCG
	▪ Temperature	***Fever:*** Blood Cultures if Temp. ≤ 35.5 or ≥ 38.5°C (must be ordered by a senior doctor); baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Ward Test Urine Send MSU if positive for nitrates and/or leucocytes Urine βHCG if female of child bearing age.

18. Hyperglycaemia (DKA)

This protocol is to be implemented for patients who present with hyperglycaemia and suspected diabetic ketoacidosis (DKA).

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

BSL > 15mmol/L
Increased thirst
Increased urine output
Dehydration

Optional Markers

Tachycardia
Weight loss
Acetone breath
Ketonuria
Abdominal pain
Kussmaul's respirations

Exclusions ⇨ ***Refer to Senior Medical Officer immediately***

Hypotension
Severe dehydration
Altered mental state / confusion
GCS < 13
(NB: Interventions maybe commenced whilst waiting review)

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, Ca Po+ , Glucose, LFT,BSL, Venous Gas , Lactate & Quantitative βHCG if +ve urine βHCG
	▪ BSL	(Notify senior medical officer if BSL ≥ 22 and/ or pH < 7.3)
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**
	▪ Urinalysis / MSU	Ward Test Urine – test for sugar & ketones Send MSU if positive for nitrates and/or leucocytes Urine βHCG if female of child bearing age.

19. STROKE / TIA

This protocol is to be implemented for patients who present following a suspected stroke or TIA.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Arm weakness
Speech abnormal
Facial droop

Optional Markers

Dysphasia
Dysphagia
Ataxia
Visual disturbances
Confusion
Dizziness
Headache
Decreased level of consciousness

Exclusions ⇨ *Refer to Senior Medical Officer immediately*

GCS < 13
Seizure

(NB: Interventions maybe commenced whilst waiting review)

Assessment		Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's, Glucose and Coag's (INR, PT & APTT)
	▪ BSL	Notify Medical Officer if BSL < 3 or >22 10mmol/L
	▪ Urinalysis / MSU	Ward Test Urine – test for sugar & ketones Send MSU of positive for nitrates and/or leucocytes

20. Liver Disease/ On Warfarin

This protocol is to be implemented for patients on warfarin or have a history of liver disease.
All mandatory markers are necessary to implement this standing order.

Mandatory Markers

History of liver disease, Alcohol Abuse, Hepatitis B,C or D
On warfarin

Optional Markers

Yellow pigmentation of skin & eyes
Dark urine
Pruritis
Abdominal pain Nausea/ vomiting/ diarrhoea
Ascites
Weight loss/ anorexia
Malaise/ fatigue
Fever/ chills/ night sweats
Muscle wasting
Peripheral Oedema
Bleeding tendency/ bruising/ ecchymosis
Melaena, Haematuria,
Haemoptysis

Exclusions ⇨ ***Refer to Senior Medical Officer immediately***

Confusion
Decreased LOC
Haemodynamically unstable
Uncontrolled bleeding/ haemorrhage/ GIH

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's, and Coag's (INR, PT & APTT)
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway**
	▪ Urinalysis / MSU	Ward Test Urine – test for sugar & ketones Send MSU of positive for nitrates and/or leucocytes

21. Jaundice

This protocol is to be implemented for patients who present with jaundice.
All mandatory markers are necesssary to implement this standing order

Mandatory Markers

Yellow pigmentation of skin & eyes

Optional Markers

Abdominal pain and / or bloating
Excessive belching/ gas
Indigestion after eating, especially fatty foods
Right shoulder or pain between scapula's back pain
Abdominal bloating
Nausea/ vomiting
Weight loss/ anorexia
Dark urine
Clay coloured stools
Diarrhoea/ constipation
Pruritis
Fevers/ chills/ night sweats
Bleeding tendency

Exclusions ⇨ ***Refer to Senior Medical Officer immediately***

GCS < 13
DOD or abuse of paracetamol, nurofen or naprosyn.
Haemodynamically unstable
(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, LFT's, and Coag's (INR, PT & APTT)
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway**
	▪ Urinalysis / MSU	Ward Test Urine – test for sugar & ketones Send MSU of positive for nitrates and/or leucocytes

NB: Diseases associated with jaundice include Liver Cirrhosis, Hepatitis A, B, C & D, Bile duct blockage, Cholecystitis, Cholangitis, Haemolytic Anaemia, Gilbert's Syndrome, Haemochromatosis, Wilson's Disease & Pancreatic Cancer.

*22.*Paracetamol Overdose

This protocol is to be implemented for patients who present with history of paracetamol ingestion greater than recommended dose.

All mandatory markers are necessary to implement this standing order

Mandatory Markers

History of ingestion

Optional Markers

Vague abdominal pain
Nausea/ vomiting
Pallor & diaphoresis

Exclusions ⇨ ***Refer to Senior Medical Officer immediately***

Ingestion ≥ 150mgs/ kg of body weight, or > 20 tablets
GCS < 13
Confusion
Seizures
Polypharmacy OD
ECG changes
Signs of liver failure (i.e hypoglycaemia, metabolic acidosis, bleeding tendency, hepatic encephalopathy, jaundice, diarrhoea, Acute renal failure).
(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	Paracetamol level 4 hours post ingestion
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway**
	▪ Urine sample	Collect Sample if history of polypharmacy , overdose including recreational drugs (Senior doctor needs to order)

NB: Common threshold for liver damage to occur from a single dose paracetamol dose is 15gms.
Risk factors for toxicity include ETOH abuse, fasting, anorexia nervosa use of certain drugs (i.e isoniazid).

23. Septic Joint/ Osteomyelitis/ Cellulitis

This standing order is to be implemented for patients who present with suspected joint sepsis, osteomyelitis and/ or cellulitis.

All mandatory markers are necessary to implement this standing order.

Mandatory Markers

Painful, swollen, warm and erythmatous joint
Erythematous and warm localised area of skin

Optional Markers

Fever
Lymphadenopathy near site
Rash
Tight glossy stretched appearance of skin
Decreased range of movement/ joint stiffness
Malaise/ myalgia
Nausea/ anorexia
General feeling of unwellness

Exclusions ⇨ ***Refer to Senior Medical Officer immediately***

Systemically unwell with signs of sepsis
Neurovascularly compromised limb

(NB: Interventions maybe commenced whilst waiting review)

	Assessment	Intervention
Measure & Test	▪ Cannulation	IV Cannula 0.9% Sodium Chloride 10ml Flush
	▪ Pathology	FBC, EUC, BSL, ESR , CRP
	▪ Temperature	***Fever:*** Blood Cultures if Temp ≤ 35.5 or ≥ 38.5°C(must be ordered by a senior doctor) ; baseline serum for hold & VBG lactate **(Commence Sepsis Pathway)**

NB: Patients at risk include those with a history of recent history of fracture/ trauma, orthopaedic surgery, artificial joints,chronic leg ulcers/ oedema, arthritis, gout, immunosupression, lupus, diabetes, peripheral vascular disease, eczema, psoriasis, long term steroid use & IVDU.

APPENDIX

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The John Hunter Hospital Emergency Department Pathology Matrix: CPATH- Feb 2012

PRESENTATION	LACTATE (VBG) COMMENCE SEPSIS PATHWAY	COAG PT	UEC	LFT	BHCG Urine / Quantative	BASELINE 8 HOUR TNI	LIPASE	FBC	GPH	Ward Urine Test / MSU / CSU	Other CBA = Child bearing age
Abdominal Pain Lower Quad + Flank Pain	Temperature <35.5 or >38.5				Urine BHCG Female CBA						Quantative BHCG if urine +ve
Abdominal Pain Upper Quadrant or Epigastric Pain	Temperature <35.5 or >38.5				Urine BHCG Female CBA						
Asthma. Requiring admission											
Cellulitis/Pneumonia	Temperature <35.5 or >38.5										
Chest Pain											
CAL	Temperature <35.5 or >38.5										
Syncope/ collapse > 35yrs	Temperature <35.5 or >38.5										
CVA / STROKE											
DKA	ATTEND		Ca Po+ BSL								Glucose
Pyleonephritis / Urinary Retention	Temperature <35.5 or >38.5				Urine BHCG Female CBA					MSU / CSU	Quantative BHCG if urine +ve
Fever for investigation Fever >24 hours duration	Temperature <35.5 or >38.5									MSU / CSU	
Fractures for OT									NOF		
G.I. Bleed											
Jaundice											
Liver D*	Temperature <35.5 or >38.5	INR									
P.V. Bleed					Urine BHCG Female CBA						Quantative BHCG if urine +ve ASSERTAIN BLOOD GROUP
Paracetamol OD											Paracetamol level 4 hours post ingestion
Confused	Temperature <35.5 or >38.5										
Pulmonary Oedema	ATTEND										
Seizures 1st presentation / Recurrent Seizure			BSL								Carbamazepine / Phenytoin Levels
Septic joint/ osteomyelitis	Temperature <35.5 or >38.5		BSL								ESR CRP

Order of the draw, VBG always FIRST
1. Plain tubes - Red, Pink
2. Sodium Citrate- Light Blue
3. Heparin- Green
4. EDTA – Purple
5. Glucose Preservative Tubes – Grey Tops

1. Document pathology ordered on medical note
2. Coagulation tubes need to be full!
3. Ring Pathology if minimum amount available
4. **If the patient is on WARFARIN check the INR**

DOES A PATIENT MANAGEMENT PLAN INDICATE NO BLOODS TO BE TAKEN

If the ward urine test is positive for nitrates or leukocytes send for MSU/CSU

Urinalysis - What do the results mean?

Specific gravity is a means by which the kidney's ability to concentrate urine is measured. The difference between the specific gravity of water and the specific gravity of the urine reflects the degree of concentration of the urine specimen, which roughly correlates with the urine osmolality. The range of urine specific gravity depends on the state of hydration and varies with urine volume and the load of solids to be excreted. When fluid intake is restricted or increased, under normal conditions, specific gravity measures the concentrating or diluting abilities of the kidneys. Loss of these capacities is an indication of renal dysfunction.

Normal values: 1.003-1.035 (usually between 1.010 and 1.025)
1.025-1.030+ (considered concentrated)
1.001-1.010 (considered dilute)

pH - The lower the pH of urine, the greater the acidity of the urine. pH is the renal tubules ability to maintain normal hydrogen ion concentration in the plasma and extra cellular fluid. An accurate measurement of urinary pH can only be obtained from freshly voided specimens. Urine pH is an important screening test for diagnosing renal disease, respiratory disease, and certain metabolic disorders

Normal values: Average range is 4.6-8. Average is approximately 6, norms can vary widely.

Leukocytes - Detection of WBC's in an uncontaminated urine sample is suggestive of pyuria (pus in the urine). A urine sample that tests positive for both nitrates and leukocytes should be retained for possible microscopic examination (micro) and culture and sensitivity testing.

Normal value: Negative

Nitrates - Specific groups of bacteria create nitrates as a by-product of their metabolism. When present, these bacteria can be indirectly detected by screening for nitrate levels. Although helpful in detecting the presence of bacteria in the urine, not all bacteria produce nitrates, thus some groups of bacteria may go undetected unless additional testing is performed.

Normal value*:* negative.
Protein - In health, the urine contains no protein or only trace amounts of protein, which consists of albumin and globulins from the plasma. Since albumin is filtered more readily than the globulins, albumin is usually very abundant in pathologic conditions. Detection of protein in urine combined with a microscopic examination of urinary sediment provides the basis for a differential diagnosis of renal disease. The persistent presence of protein in the urine is the single most important indication of renal disease

Normal values: negative.

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Glucose - The presence of glucose in the urine is not necessarily abnormal. Glucose may appear in the urine after a heavy meal is ingested or in conjunction with emotional stress. In the majority of cases however, glucose in the urine is abnormal and is usually due to diabetes mellitus. It must be noted that glucose in the urine is not diagnostic of diabetes mellitus and further testing must be performed to establish such a diagnosis. Increased glucose in the urine can also be attributed to conditions such as brain injury, myocardial infarcts, and a lowered renal threshold

Normal values: negative

Ketones - Excess production of ketones in the urine is mainly associated with diabetes. The body's alkaline reserves thus become depleted, resulting in acidosis. There are exceptions. Some diets in which weight loss is desired utilize high protein diets and limit carbohydrate intake to create this acidotic condition artificially.

Normal values: negative.

Urobilinogen - Urinary urobilinogen is increased by any condition that causes an increase in the production of bilirubin and by any disease that prevents the liver from normally removing the reabsorbed urobilinogen from the portal circulation. Examples of common conditions that increase urobilinogen are infectious and toxic hepatitis, pulmonary infarcts, and chemical injury to the liver, cirrhosis, and congestive heart failure. Destruction of red blood cells also causes an increase in urobilinogen in conditions such as haemolytic and pernicious anaemia’s, as well as infectious conditions like malaria.

Normal values: random samples, negative**.**

Bilirubin - Bilirubin in the urine is an early sign of hepatocellular disease or intrahepatic or extrahepatic biliary obstruction and should be performed in every urinalysis. Bilirubin may often appear in the urine before other signs of liver dysfunction, such as jaundice or clinical illness, are apparent.

Normal values: negative.

Blood - Blood in the urine is usually occult blood that has been haemolysed or dissolved. Haemoglobin or red blood cells in the urine are not likely to be identified by the unaided eye when there is less than one part of blood per 1000 parts of urine. When intact red blood cells are present in the urine, the term hematuria is used to indicate bleeding somewhere in the urinary tract. Haematuria is common in lower UTI's, and can be found in patients with lupus, malignant hypertension, sub acute bacterial endocarditis and even heavy smokers.

Normal values: negative

Venipuncture and peripheral IV cannulation

Special considerations

Collapsed veins

The most common cause of collapsed veins is withdrawing the syringe plunger too quickly during venipuncture. This also occurs more commonly when smaller veins are assessed during venipuncture.

Oedema

Avoid oedematous areas when selecting a site for venipuncture. Not only will the veins be hard to palpate but the specimen may be contaminated with fluids.

Obesity

Be careful when collecting blood from obese patients as excessive probing of the site in search of a vein may result in the rupture of the red blood cells, an increased concentration of intracellular contents or the release of tissue clotting factors.

IV Therapy

Do not collect blood from the arm in which an IV is running as the IV fluids will cause dilution and may cause inaccurate results. If there is no choice but to use the arm, turn the IV off for 5-10 minutes prior to collecting the blood and **discard the first 2 mls of blood.**

Special considerations

Avoid taking blood from the affected arm in a mastectomy patient or patients who have had or are expecting to have a AV fistula inserted. Avoid scarred areas such as burns or skin grafts.

Points to consider

Minimum Volumes: If a patient is known to be difficult to obtain blood from, check with pathology prior to collection to ascertain minimum volumes required.

Delays in transporting specimens may result in degradation or may reduce the biological nature of the specimen.

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