

Drug and Therapeutics Newsletter

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All formulary changes and policy/procedure updates have been approved by the Drugs and Therapeutics (D&T) Committee and Medical & Academic Advisory Council (MAAC).

This and other Drug and Therapeutics Newsletters are available on our website at www.vhpharmsci.com

Changes to Formulary

Additions

- 1. Eptifibatide injection (Integrilin®)**
 - Platelet inhibitor (glycoprotein IIb/IIIa receptor antagonist)
 - Restricted to cardiology
 - See page 2 for review
- 2. Tirofiban injection (Aggrastat®)**
 - Platelet inhibitor (glycoprotein IIb/IIIa receptor antagonist)
 - Restricted to cardiology
 - See page 2 for review
- 3. Ketorolac injection (Toradol®)**
 - Parenteral non-steroidal anti-inflammatory drug (NSAID)
 - Restricted to post-operative pain management of donor nephrectomy patients
 - See page 5 for drug review

ERRATUM from Volume 7, Number 3 Indigotindisulfonate (Indigo Carmine®)

- This product was back-ordered, not discontinued from the manufacturer and is still on formulary

Updated Policy/Procedures

Acetylcysteine (Mucomyst®)

Elizabeth Goodfellow RRT, Respiratory Services Department

Acetylcysteine is a mucolytic agent commonly nebulized in patients to decrease the thickness of pulmonary mucous secretions. At VHHSC, one of the problems encountered with acetylcysteine administration is that when it is nebulized using a normal nebulizer (i.e. as per nebulization with salbutamol—Ventolin®), it produces a dense mist that very often sets off the smoke detectors causing a false alarm. In order to rectify this problem, it is recommended that acetylcysteine always be administered via a special nebulizer called Circulaire®. When acetylcysteine is dispensed by Pharmaceutical Sciences CSU, a brightly coloured label will be added indicating that prior to use, a clinical Respiratory Therapist should be consulted. The Respiratory Therapist will then be able to assist the nursing staff in determining the best method by which to deliver acetylcysteine effectively and safely to the patient.

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NEW DRUG/DRUG PRODUCTS

1. Glycoprotein IIb/IIIa Antagonists for the Treatment of Acute Coronary Syndromes

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Introduction

Acute coronary syndromes (ACS) include unstable angina (UA) and non-Q-wave myocardial infarction (MI). The pathophysiology of ACS involves atherosclerotic plaque rupture and subsequent activation of the coagulation system to form a thrombus. Platelet adhesion, activation and aggregation are important events in thrombus formation.^{1,2} Many factors can stimulate the cascade of events that lead to platelet aggregation, but the final common pathway for platelet aggregation involves fibrinogen binding to the platelet glycoprotein (GP) IIb/IIIa receptor and linking activated platelets together.³ GP IIb/IIIa antagonists block these receptors and therefore inhibit platelet aggregation.

Comparison of Available Agents

Three GP IIb/IIIa receptor antagonists are currently available on the Canadian market: abciximab, eptifibatide and tirofiban (Table 1). Abciximab is on formulary at VHHSC for use as adjunctive therapy with percutaneous coronary interventions (PCIs). Eptifibatide and tirofiban have been recently added to formulary for the treatment of ACS with or without PCI. Abciximab is a monoclonal antibody that irreversibly binds to the GP IIb/IIIa receptor and inhibits platelet function for up to 24-48 hours after the infusion is discontinued.⁴ Both eptifibatide and tirofiban are small molecules that reversibly bind to the GP IIb/IIIa receptor, enabling platelet function to return to normal within 4 hours of discontinuing treatment.⁵⁻⁷ Because abciximab is a monoclonal antibody of murine origin, there is potential for antibody formation which could result in allergic reactions or diminished efficacy upon readministration of the drug.⁸ Eptifibatide and tirofiban do not cause antibody formation. Abciximab is eliminated from the body by proteolytic breakdown, whereas eptifibatide and tirofiban are primarily eliminated renally.^{5,9}

Table 1. Properties of Intravenous Glycoprotein IIb/IIIa Antagonists

Drug	Abciximab (Reopro®)	Eptifibatide (Integrilin®)	Tirofiban (Aggrastat)®
Indications For Use	Adjunct to PCI only	ACS ± PCI	ACS ± PCI
Platelet Inhibition	Irreversible	Reversible	Reversible
Molecular Structure	Monoclonal antibody (MW = 50,000)	Cyclic peptide (MW = 800)	Nonpeptide (MW = 500)
Immunogenicity	Yes	No	No
Route of Elimination	Proteolytic breakdown	Renal	Renal
Normalization of Bleeding Time After Discontinue Therapy	24-48hrs ^{4,8}	4-6hrs ^{6,10}	4-8hrs ^{7,11}
Incidence of Severe Thrombocytopenia ^a	1% ¹² (platelets < 50/mm ³)	0.2% ¹³ (platelets < 20/mm ³)	0.5% ¹⁴ (platelets < 50/mm ³)
Dose	0.25mg/kg IV bolus, then 0.125µg/kg/min infusion (max 10µg/min) for 12 hours	180µg/kg IV bolus (max 20mg), then 2µg/kg/min (max 15mg/hr) infusion for 48-72 hrs	0.4µg/kg IV bolus over 30 mins, then 0.1µg/kg/min infusion for 48-72 hours
Dosage adjustment for renal impairment	None	Do not use if Creatinine > 180µmol/L ¹⁰	Decrease bolus and infusion by 50% if CrCl < 30mL/min ¹¹
Cost for 70kg Patient ^b (treatment duration)	\$1600.00 (12 hours)	\$1040.00 (72 hours)	\$945.00 (72 hours)

PCI = percutaneous coronary intervention; ACS = acute coronary syndromes; MW = molecular weight; CrCl = creatinine clearance
^athrombocytopenia significant only for abciximab compared to placebo
^bbased on VHHSC drug acquisition costs

Clinical Trials

Three published randomized, double blind, placebo controlled trials have assessed the role of GP IIb/IIIa antagonists in the management of

ACS. The Platelet Receptor Inhibitor in Ischemic Syndrome Management (PRISM) trial compared tirofiban plus ASA to heparin plus ASA for the treatment of 3232 patients with UA or non-Q-wave MI.¹⁵ Although tirofiban showed favourable results, this trial did not enable assessment of using tirofiban in addition to heparin and aspirin, which is the current standard of practice.

The PRISM in Patients Limited by Unstable Signs and Symptoms (PRISM PLUS) study compared tirofiban, heparin, and the combination for the treatment of 1915 patients with ACS.¹⁴ Patients were randomized within 12 hours of chest pain to receive either tirofiban alone, tirofiban plus heparin infusion, or heparin infusion alone. All patients received aspirin 325 mg daily. The tirofiban alone arm was terminated early due to excess mortality as compared to the heparin arm at seven days. Mean duration of therapy in all groups was 71.3 hours. Tirofiban with heparin showed a significant reduction in the incidence of the primary endpoint (death, MI, or refractory ischemia) at 7 days as compared to heparin alone (12.9% vs. 17.9%, $p = 0.004$).¹⁴ This corresponds with a number needed to treat (NNT) of 20 patients in order to avoid one event at 7 days. At 7 days, the majority of the benefit was accounted for by a reduction in refractory ischemia and MI with no difference in mortality between the groups. The initial benefit to therapy with tirofiban was sustained at 30 days and 6 months. Of note, the benefit from therapy with tirofiban was greatest in the 475 patients who went on to receive PCI after randomization; the incidence of the composite endpoint (death, MI, refractory ischemia, or rehospitalization for unstable angina) in this subgroup at 30 days was 8.8% in the tirofiban plus heparin group and 15.3% in the heparin alone group (risk ratio 0.55, 95% confidence interval [CI] (0.32-0.94)).¹⁴ In comparison, there was no significant difference in the incidence of the composite endpoint in the 719 patients who did not undergo PCI (14.8% tirofiban plus heparin vs. 16.8% heparin; risk ratio 0.87, 95% CI 0.60-1.25).

The Platelet Glycoprotein IIb/IIIa in Unstable Angina: Receptor Suppression Using Integrilin Therapy (PURSUIT) trial compared low and high dose eptifibatide to placebo for the treatment of 10,948 patients with ACS.¹³ Patients were randomized within 24 hours of chest pain to

receive either eptifibatide 180 mcg/kg bolus, then 1.3 mcg/kg/min or eptifibatide 180 mcg/kg bolus, then 2.0 mcg/kg/min or placebo. Aspirin was administered at the physician's discretion, and subcutaneous or intravenous heparin was recommended. Most patients were treated with aspirin (93%) and heparin (89.9%). The low dose eptifibatide arm was dropped when it became clear that the higher dose had an acceptable safety profile. Patients were treated for a median duration of 72 hours. Eptifibatide showed a significant reduction in the incidence of the primary endpoint (death or MI) at 30 days as compared to placebo (14.2% vs. 15.7%, $p = 0.04$).¹³ This corresponds with an NNT of 67 in order to prevent one event at 30 days. There was no difference in the individual endpoints of death or MI. As in the PRISM PLUS study, the subgroup of 1228 patients who went on to receive PCI after randomization showed the greatest benefit from therapy with eptifibatide (composite endpoint at 30 days 11.6% eptifibatide vs. 16.7% placebo, $p = 0.01$) compared to patients who did not receive PCI (14.5% vs 15.6%, respectively, $p = 0.23$).¹³ Table 2 compares the major endpoints of the PRISM PLUS and PURSUIT

Table 2. Comparison of Major Endpoints of PRISM PLUS and PURSUIT trials

Trial	PRISM PLUS ¹⁴	PURSUIT ¹³
Drugs	Tirofiban (T) alone ^a Tirofiban + Heparin or Heparin (H) alone	Eptifibatide (E) low dose ^a Eptifibatide high dose or Placebo (P)
Adjunctive Therapy	ASA (100%)	ASA (93%) Heparin (89.8%)
Results: Primary Endpoint	(death, MI, refractory ischemia) <u>7 days</u> 12.9% (T + H) vs 17.9% (H) ($p=0.004$)	(death or MI) <u>30 days</u> 14.2% (E) vs 15.7% (P) ($p=0.04$)
Results: Composite Endpoint with PCI	<u>30 days</u> ^b 8.8% (T+H) vs 15.3% (H) (95% CI 0.32-0.94)	<u>30 days</u> ^c 11.6% (E) vs 16.7% (P) ($p=0.01$)
Results: Composite Endpoint without PCI	<u>30 days</u> ^b 14.8% (T+H) vs 16.8% (H) (95% CI 0.60-1.25)	<u>30 days</u> ^c 14.5% (E) vs 15.6% (P) ($p=0.23$)

PCI = percutaneous coronary intervention; CI = confidence interval
^athis arm terminated early

^bcomposite endpoint included death, MI, refractory ischemia, or rehospitalization for unstable angina

^ccomposite endpoint included death or MI

trials.

It is interesting to note that although tirofiban and eptifibatide have shown benefit when used in combination with heparin and aspirin in the medical management of ACS, the recently completed Global Use of Strategies to Open Occluded Arteries (GUSTO-4) trial failed to confirm the benefit of GP IIb/IIIa antagonists for ACS. GUSTO-4 compared abciximab in a 24 or 48 hour infusion to placebo for patients with ACS receiving either heparin or low molecular weight heparin. Fewer than 5% of the study patients went on to receive PCI. Abciximab 24 and 48 hour infusions had no effect on the primary endpoint of death or MI at 30 days as compared to placebo (8.2% vs. 9.1% vs. 8.0%, respectively). The results of this trial have been presented at the 22nd Congress of the European Society of Cardiology meeting and are awaiting full publication.¹⁶

Adverse Drug Reactions

Adverse effects of platelet GP IIb/IIIa antagonists include bleeding and thrombocytopenia. Thrombocytopenia has been reported to occur within a few hours of initiating treatment with GP IIb/IIIa antagonists.¹⁷ Although the mechanism remains unknown, several immune mechanisms have been proposed including: antibody formation against the platelet-drug complex, or formation or activation of previously formed antibodies triggered by binding of drug receptor.^{18,19} The thrombocytopenia is generally transient, and improves with drug discontinuation.¹² Because of the potential for profound thrombocytopenia (Table 1), it is recommended to monitor platelet counts at baseline, within 1 to 4 hours of therapy and daily during therapy.¹⁷ If the platelet count falls to less than 50/mm³, discontinuation of the GP IIb/IIIa antagonist is recommended. Platelet counts should then be performed twice daily until counts exceed 50/mm³.¹⁷ Platelet transfusions have been suggested for treatment of life threatening bleeding associated with thrombocytopenia for all three agents.¹⁷ However, the utility of platelet transfusions for thrombocytopenia caused by tirofiban and eptifibatide has been questioned because the pharmacology of eptifibatide and tirofiban is such that drug molecules greatly outnumber

platelet receptors, thus aggregation of new platelets is quickly inhibited.²⁰

In PRISM PLUS, tirofiban was associated with a higher discontinuation rate from total bleeding (3.5% tirofiban plus heparin vs. 1.3% heparin alone, $p = 0.004$), although there was no difference in the incidence of major bleeding (4% vs. 3%).¹⁴ In PURSUIT, eptifibatide was associated with more minor bleeding (12.9% vs. 7.4%) and an incremental higher risk of major bleeding (10.6% vs. 9.1%) than placebo.¹³ For patients who are receiving eptifibatide or tirofiban and require coronary artery bypass graft (CABG) surgery, it has been proposed that infusions be discontinued 4 hours before elective surgery, and that there be no delay in emergency surgery because platelet function returns to normal within 4 hours of discontinuation of these agents.^{10,11,21} If patients have received abciximab, it is recommended that elective CABG be delayed for 24 - 48 hours and emergency CABG be delayed for 12 hours, if possible.²¹ To date, no large randomized controlled trials have assessed the role of GP IIb/IIIa antagonists used in combination with thrombolytic agents; due to the increased risk of bleeding and lack of published data on clinical outcomes, this combination cannot be recommended at present.

Due to potential for adverse effects, there are several important contraindications to therapy with GP IIb/IIIa antagonists. A summary of these

Table 3. Contraindications to Therapy with Eptifibatide and Tirofiban for ACS

Serum creatinine > 180 $\mu\text{mol/L}$ (eptifibatide) Active bleeding History of bleeding diathesis within 30 days Platelet count < 100/mm ³ Major surgery or trauma within 30 days Severe uncontrolled hypertension (SBP > 180 mmHg or DBP > 110 mmHg) Aortic dissection Acute pericarditis History of stroke within 30 days Any history of hemorrhagic stroke, intracranial neoplasm, AV malformation or aneurysm, vasculitis Clinically significant liver disease Elevated baseline INR
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contraindications is presented in Table 3.

Economic implications

To date, there are no published Canadian studies to assess the pharmacoeconomic implications of the use of GP IIb/IIIa antagonists for ACS. American analyses suggest that the cost to prevent one death or MI through use of these agents for ACS ranges from \$32,000 (US) to \$82,000 (US).^{22,23} Both eptifibatide and tirofiban have been shown to be more cost effective in patients who receive adjunctive PCI; in this group costs per death or MI prevented at 30 days range from \$21,000 (US) to \$32,000 (US).^{22,23}

Conclusion

Both eptifibatide and tirofiban have shown benefit in reducing the composite of death, MI or refractory ischemia in patients with ACS. Since the benefit associated with these drugs is best observed in patients who go on to receive PCI, and the cost associated with these agents is significant, the evidence is in favour of treating high risk ACS patients who will proceed to receive PCI. At VHHSC, the use of eptifibatide and tirofiban for patients with unstable angina or non-Q-wave MI is restricted to those with planned PCI during therapy and for patients with refractory ischemia despite standard treatment with ASA, intravenous unfractionated heparin or subcutaneous low molecular weight heparin, intravenous nitroglycerin and a beta-blocker (if not contraindicated). The prescribing of these agents must be approved by a cardiologist.

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2. KETOROLAC INJECTABLE (Toradol®)

Karen Shalansky, Pharm.D., FCSHP, Peter Loewen, Pharm.D.

Parenteral ketorolac is a non-steroidal anti-inflammatory drug (NSAID) indicated for the short-term management (maximum 5 days) of moderate to severe post-operative pain. At VHHSC, parenteral ketorolac is restricted to post-operative pain management of donor nephrectomy patients. While this drug is only approved for intramuscular (IM) use in Canada, it is approved in the USA for intravenous (IV) use. Of note, oral ketorolac remains a non-formulary drug and all orders for oral ketorolac 10mg are interchanged to indomethacin 25mg.

Comparison to Other Formulary Agents

There is no data to indicate that ketorolac is superior to other NSAIDs.¹ The sole advantage of this drug is that it is the only injectable NSAID marketed in Canada. Since 1991, there have been at least 160 published articles that directly compare ketorolac to another proven strategy for the management of post-operative pain. Overall, these trials demonstrate that at recommended doses, parenteral ketorolac displays similar or

superior analgesic efficacy to parenteral morphine, meperidine and various other NSAIDs (parenteral or rectal) for the management of post-operative pain.

Direct comparisons of IM ketorolac to rectal NSAIDs in prospective, blinded studies, have shown ketorolac 30mg IM to be equivalent to rectal indomethacin 100-200mg for the management of pain following gynecologic/breast surgery², oral surgery³, and elective laparoscopic sterilization⁴. Intravenous ketorolac 10mg and rectal diclofenac 100mg, both administered pre-operatively in a double-blind controlled trial, provided comparable post-operative pain relief following knee arthroscopy.⁵

Potential Advantages

Unlike opioid analgesics, ketorolac does not cause respiratory depression, tolerance or dependence, or inhibition of gastrointestinal (GI) motility. As well, ketorolac may be administered less frequently than narcotics due to a longer duration of action of 4-6 hours following IM or IV injection.⁶

Potential Risks

Similar to other NSAIDs, ketorolac may cause acute renal failure, especially in patients who are volume depleted or have some degree of renal impairment.¹ A potential for gastric mucosal irritation and peptic ulceration exists. In a double-blind trial of 52 weeks duration, the incidence of peptic ulceration +/- GI bleeding from oral ketorolac 10mg QID was 1.6% (9/553 patients) compared to 1.1% (3/270 patients) with aspirin 650mg QID.⁷ Ketorolac also significantly prolongs bleeding time from a baseline of 4.9 minutes to 7.8 minutes after multiple dosing.⁸ Ketorolac can cross-react with aspirin and other NSAIDs and is contraindicated in individuals who are hypersensitive to these drugs.

Dose and Cost Comparison

Ketorolac may be administered by intermittent bolus injection at a dose of 10-30mg IV/IM q4-6h or via IV infusion. After a 15-30mg IV bolus, ketorolac infusion is administered at a rate of 2.5-5mg/hr. The maximum daily dose is 120mg for a maximum of 5 days. Table 1 illustrates

Table 1. Cost/Dose Comparison of Ketorolac to Other Formulary Analgesics

Drug	Regimen	Cost/Day ^a
<u>Intravenous</u>		
Ketorolac	IV intermittent	\$8.50
	IV infusion	\$8.50
Morphine	30mg IV q6h 30mg bolus, then 2.5-5mg/hr (avg. 120mg/day 10mg IV q4h	\$1.10
<u>Rectal</u>		
Indomethacin	100mg PR q12h	\$2.85
Diclofenac	50mg PR q8h OR	\$2.65
	100mg q12h	\$3.00

^abased on VHHSC acquisition costs

dose and cost comparisons of ketorolac.

Conclusions

Parenteral ketorolac has proven to be a viable, albeit more expensive, alternative to narcotics or other rectal NSAIDs for the management of post-operative pain. Like other NSAIDs, this drug has the potential to cause GI bleeding and acute renal failure, and should be used cautiously in patients with a history of peptic ulcer disease, prolonged bleeding time or renal impairment. As well, it is contraindicated in patients who are allergic to aspirin or other NSAIDs. At VHHSC, ketorolac is reserved for post-operative pain control in donor nephrectomy patients who cannot tolerate oral or rectal NSAIDs or opiate analgesics.

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Infusion Program IV Resource Nurse Consult Service

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Background

The Infusion Program (IP) was implemented in 1998 to provide vascular access-related clinical, educational and research support to Vancouver General Hospital (VGH). This program is coordinated by Pharmaceutical Sciences CSU and is comprised of a multi-disciplinary team of nurse educators, IV resource nurses and pharmacists. The IV resource nurses provide a 7-day/week consult service for inpatients with difficult peripheral IV initiations or IV device complications. In response to telephone or pager-based consults, the IV resource nurse reviews the health record to determine the current and anticipated future need for IV access. This is followed by a direct assessment of the patient's vascular access status. Depending upon the patient's needs, the IV resource nurse may either initiate one of a variety of peripheral IV catheters or refer the patient to an IP educator for consideration of an alternative device.

To assess the characteristics of the service being provided by the IV resource nurses, an assessment of service consults was conducted.

The IV resource nurses are responsible for the daily collection of workload statistics to characterize the magnitude and nature of the consult service being provided. In early 1998, the team developed a standard 12-field workload data form for this purpose. This form is used to prospectively document consult-related information including date/time of the consult, patient demographics, device characteristics, patient vein status (as rated by the IV resource nurses), previous vascular attempts performed by ward staff immediately prior to consultation, phlebitis rating (using the Baxter phlebitis rating scale¹), vascular restrictions, the presence of any complications and the consult outcome. Using this database, a random sample of 250 inpatients who received an IP consult during a 12-month period (August 1/98 - July 31/99) was chosen for review. Only patients with complete data for the randomly selected consult episode were included.

Results

During the 12-month study period, the IV resource nurses recorded 10,842 consults. Seven hundred and eighty-nine consults were recorded for the 250 randomly selected patients (median 2 consults/patient, range 1-30). One hundred and sixty patients (64%) were referred to the service on more than one occasion. The median interval between the initial and final consult was 6 days (range 1 – 68 days). The distribution of patients and consults by service is shown in Table 1.

Table 1. Distribution of 250 Randomly Selected Patients for Infusion Program Consult

Service Area	# Patients (%)	# Consults (%)
Surgical^a	114 (46)	385 (49)
Medical^b	102 (41)	340 (43)
Critical Care^c	22 (9)	33 (4)
Other^d	12 (5)	31 (4)
Total	250 (100)	789 (100)

^aincludes General, Thoracic, Vascular, and Orthopedic Surgery, ENT, Gynecology, Urology, Transplant, Trauma, and Surgical Short Stay

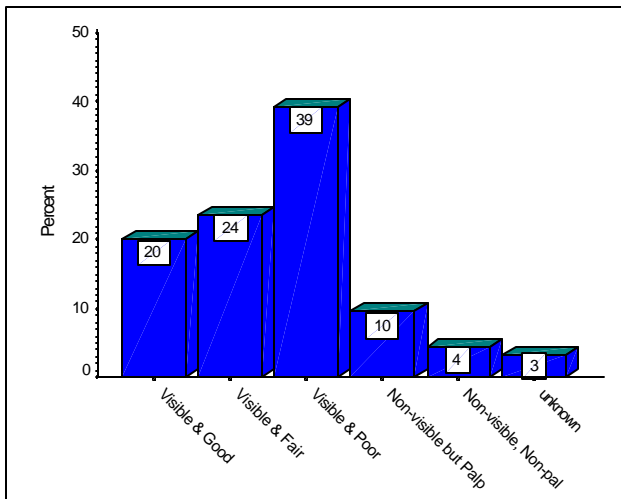
^bincludes CTU, Family Medicine, Neurology, BMT, Respiratory, GI
^cincludes Burns and Plastics, Cardiac Care, Emergency, and all Intensive Care Units

^dincludes Discharge Planning, Rehab Medicine, Palliative Care, Psychiatric Assessment Unit, and all outpatient clinics

Consults were received from 33 wards at VGH. However, the majority of consults were generated by surgical and medical services with an equal distribution between these two groups. The number of consults per patient was also similar between these two groups and was lower for critical care patients. The highest number of consults were recorded for the general surgery wards (162 or 21% of total) with the general/vascular surgery wards recording the second highest number of consults (82 or 10% of total). The balance of wards had fewer than 10% of the total consults each. When repeat consults per patient were assessed by ward, a wide variation (range 1-5.4 consults/patient) was observed. Once again, the highest number of repeat consults per patient was recorded for the general surgery wards.

According to the IV resource nurse documentation, 208 (83%) patients had visible veins on first consult, with approximately one-half of these visible veins being rated as either "fair" or "good" by the IP resource nurse (Figure 1). Vein status was most commonly graded as "visible and poor" (98 patients or 39% of total). At the time of the first consult, 165 (66%) patients were free from any evidence of phlebitis, while 78 (31%) patients were considered to have phlebitis rating of +1 (i.e. painful, red and/or edematous).

Figure 1. Vein Status



Of the 789 consults recorded, 638 (81%) resulted in the initiation of peripheral IV catheters into an area of non-flexion in an upper extremity. When necessary, a less optimal insertion into an area of flexion or the foot was undertaken. This occurred in approximately 73 (9%) consults. Successful peripheral IV initiations were accomplished in 759 (96%) of all consults.

No immediately previous vascular access attempts were performed by ward nurses for 448 (57%) of recorded consults. Of those consults for which vein status was recorded (N=431), 255 (59%) involved patients with vein status designated as "visible and poor" or "non-visible, non-palpable". Of the remaining consults, 64 (15%) had restrictions (e.g. AV fistula, multiple previous venipuncture sites, arm trauma/surgery) that would have limited the number of sites available for access and 22 (5%) involved patient care areas where IV initiations are infrequent (eg. psychiatric assessment unit). The remaining 90 consults (21%) were initiated without any immediately previous attempts by ward nurses on

patients and with "visible and good/fair" or "non-visible but palpable" veins. Furthermore, these consults were performed on patients without any vascular restrictions who were located on wards where IV initiations are frequent.

Discussion

This study has provided us with some insight into the nature of the service being provided by the IV resource nurses in this institution. It appears from our results that the service is commonly consulted by medical and surgical patient care areas with some particularly high usage wards. Almost all consults resulted in the successful placement of a peripheral IV device. Most of the patients consulted to the service appear to have visible veins, and about one-half of these patients were considered to have good or fair access. However, we must be cautious in the interpretation of vein status as a relatively subjective rating scale was employed and the assessments were potentially affected by inter-rater variability.

The IP supports the concept of utilizing the IV resource nurse service for patients with poor vein status, a documented history of difficult peripheral IV access, and in patient care areas for which IV initiations are infrequent. In the latter situation, nurses often lack the opportunity to maintain their IV skills. In patient care areas where the care and maintenance of an IV constitutes a major component of the nursing care provided, we believe patients with visible and "good or fair" veins or "non-visible, but palpable" veins should ideally have their IVs initiated by their primary care nurse.

The IP currently provides a number of education programs to enhance the IV initiation skills of staff nurses including basic and advance IV training, and ward-based IV initiation education and preceptorship programs. The IV resource nurses also provide "just in time" training if specifically requested. While these structured activities improve IV skills, maintenance and further improvement of these skills requires nursing commitment and a supportive practice environment.

Reference

1. Baxter Healthcare Ltd. Principles and Practice of IV Therapy. Compton: Baxter Healthcare Ltd; 1988.