Rapid Quantification of Hemoglobin S

Introduction and Background

Sickle cell disease (SCD) is due to an inherited variant hemoglobin, hemoglobin S (Hb S). When Hb S is in a deoxygenated state, it polymerizes, resulting in the sickle red blood cell (RBC) shape. In SCD the cells tend to get stuck, causing vaso-occlusion and clog blood flow to vital tissues and organs, causing extreme acute and chronic pain, particularly in areas where the bone marrow is active. Additionally, recurrent RBC sickling causes cell membrane damage, resulting in haemolytic anemia.

SCD has the highest prevalence in malaria-endemic areas of the world, including sub-Saharan Africa, southern Europe, the Middle East India and the Caribbean. With worldwide migration patterns, rates of SCD are increasing in North America and Northern Europe. Approximately 300,000 affected infants are born worldwide annually. Newborn screening for SCD was introduced in Ontario approximately 12 years ago. SCD is diagnosed with hemoglobin separation methods such as hemoglobin electrophoresis, high-performance liquid chromatography and capillary electrophoresis.

After initial diagnosis, many patients require serial quantification of Hb S for monitoring of disease-modifying therapy with RBC transfusion and/or hydroxyurea. Hydroxyurea is an oral, daily medication that helps to reduce acute and chronic complications of SCD. In acute care settings, results of Hb S quantification may be required urgently, such as when
patients are being treated for life-threatening stroke or chest complications.

In the HRLMP Red Cell Disorder (RCD) laboratory, located at HHS McMaster site, testing for SCD and other hemoglobinopathies are performed. Turn-around-time for the comprehensive “Hemoglobinopathy screen” panel can be as long as 4 weeks depending on results of initial testing. The RCD laboratory is also the HRLMP site for Hemoglobin A1c (HbA1c) testing for the clinical management of diabetes, using capillary electrophoresis (CE). HbA1c test results are available within two business days due to simplicity and frequency of running this test on CE. Since CE can also be used to identify and quantify Variant Hemoglobins, in particular Hemoglobin S (Hb S), our lab sought to validate a rapid turn-around-time quantification of Hb S using the CE HbA1c kit for confirmed SCD patients receiving therapy.

Methods

High voltage capillary electrophoresis separates Hemoglobin F, A, S, X by direct mobility and electroosmotic flow. We hypothesized that using the electropherograms from the HbA1c assay would allow quantification of Hb S and allow our laboratory to provide a rapid result to our clinicians on confirmed Hb S patients to monitor effects of therapy. We analyzed thirteen patients with Hb S Disease or Trait and measured the % S on the A1c and Hemoglobin E programs. Our laboratory uses the electropherograms from the HbA1c assay and quantifies Hb S on confirmed SCD patients to monitor the effects of therapy. (Figure 1)

Results

The HbA1c kit was noted to underestimate Hb S by an average of 5% on patient samples as compared with the Hb E kit. While important to highlight, this difference was not considered to be clinically significant. We attach a standardized comment with each result.

“Hb S quantification determined using the capillary electrophoresis A1c program. On average this method will underestimate the Hb S percentage by 5%. If a more precise quantification is required please contact the Red Cell Disorders Laboratory.”

By:

Kelly Lightfoot, MLT, HRLMP RCD laboratory
Dr. Madeleine Verhovsek, HRLMP Consultant Hematologist, RCD laboratory

Figure 1: Capillary Electropherograms of a Normal Profile and an Atypical Profile
News from Administration

After 31 years with our Laboratory Program, Duane Boychuk has decided to take on another adventure as the Director, Diagnostic Imaging, at St. Joseph’s Healthcare, Hamilton.

Throughout his career, Duane has always embraced lifelong learning and innovation and has led several innovative projects. Thank you Duane, and all the best in your new position!

We would also like to congratulate Sandra Fazari as she has accepted the interim role of HRLMP Director of Operations.

To read the full announcement, please click on the link below: Duane Boychuk Announcement_June 24, 2019.pdf

We would also like to say thank you and all the best to Sylvia Alvarez, HRLMP Program Secretary, as she transitions to the private sector.

Sylvia was with the HRLMP for just under a year and made the Program Secretary role her own. Her enthusiasm and ready laugh will be missed.

Sylvia’s last day with the HRLMP was Friday August 23, 2019.

Education News

There are numerous upcoming continuing education opportunities throughout the fall for your consideration:

News from the Core Laboratory

Congratulations to the following HRLMP Core Laboratory staff members who retired this summer.

Lynne Therrien - June 28
Sandra Barbour - July 25
Lois Gurzanski - August 5

Thank you for your many years of service and all the best in the next stage of your lives.
We are pleased to announce our new partnership with Ortho Clinical Diagnostics to phase in NEW dry-slide chemistry analyzers by March 2020!

Background

As some may already know, the HRLMP has been operating the Abbott Architect series of chemistry analyzers for nearly 8 years. As such, these chemistry analyzers are nearing the end of their useful life. To replace the Abbott analyzers, a request for proposal (RFP) process was completed, with input from various stakeholders in the organization, including team members from our frontline. On July 15, 2019, the decision was made to replace the Abbott Architect series of chemistry analyzers with the Ortho VITROS series of dry-slide chemistry analyzers from Ortho Clinical Diagnostics.

The distribution of the new equipment will be as follows:

<table>
<thead>
<tr>
<th>Site</th>
<th>New Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Joseph’s Healthcare Hamilton (SJHH)</td>
<td>• 2x VITROS XT 7600 chemistry analyzers</td>
</tr>
<tr>
<td>Hamilton General Hospital (HGH) Core and CCI</td>
<td>• 3x VITROS XT 7600 chemistry analyzers</td>
</tr>
<tr>
<td></td>
<td>• 1x VITROS 3600 immunodiagnostic system</td>
</tr>
<tr>
<td>Juravinski Cancer Centre (JHCC)</td>
<td>• 2x VITROS XT 7600 chemistry analyzers</td>
</tr>
<tr>
<td>McMaster University Medical Centre (MUMC)</td>
<td>• 2x VITROS XT 7600 chemistry analyzers</td>
</tr>
<tr>
<td>West Lincoln Memorial Hospital (WLMH)</td>
<td>• 1x VITROS XT 7600 chemistry analyzers</td>
</tr>
</tbody>
</table>

The Approach

An interdisciplinary project team of approximately 40 members, including technical and operational specialists, managers and administrators, and expert consultants, has been assembled to facilitate a seamless transition to the new chemistry analyzers. In addition, specialists from Ortho Clinical Diagnostics will be working closely alongside our key operators and technical specialists to ensure a successful transition.

To ensure a successful transition to the Ortho VITROS analyzers, it was decided that the project scope would be limited. In this first phase of the rollout, from now until March 2020, the focus will solely be to:

- Roll out the 10 Ortho Clinical Diagnostics VITROS XT 7600 chemistry analyzers and 1 VITROS 3600 immunodiagnostic system;
- Rollout the middleware build (In this first iteration for autoverification, current tests for autoverification will stay the same.)
- Go live by mid-February 2020.

After March 2020, and after we understand how we can optimize the use of the new instruments, a new list of improvement initiatives will be decided upon.

What to Expect Next

- In the next couple weeks, Engineering will be conducting site inspections and minor renovations in preparation for the installation of the new instruments.
- New instruments are scheduled to arrive by the end of August or early September.
- In the coming weeks, key operators will be selected and will be asked to complete: online training, in-person training at their HRLMP sites,
and in-person training the Ortho’s Rochester facility.  
• After training is completed, key operators will begin the validation process on the new instruments.  
• The project team will be meeting every 2 weeks to provide progress updates.

Submitted by:  
**Brian Banh**, Project Lead  
**Tracy Carrier**, HRLMP Core Laboratory Manager

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**Hematology News**

**A Stem Cell Legacy**

*Hamilton Health Sciences (HHS)* has a long and accomplished history in providing stem cell transplants to blood cancer patients. As part of HHS, Juravinski Hospital and Cancer Centre (JHCC) is one of only three hospitals in Ontario providing all forms of adult stem cell transplants.

In July 2019, JHCC celebrated a major milestone when **Dr. Brian Leber** performed the thousandth allogeneic stem cell transplant.

**Dr. Irwin Walker**, a leader in hematology at JHCC, is a pioneer in the field of unrelated allogeneic stem cell transplants.

In 1988, Dr. Walker performed the first successful Canadian transplant with an unrelated donor, who was infused with stem cells that were collected from a donor in the United States.

Amazing accomplishments! Congratulations.

Click on the link below for to read the full story:  
[https://www.hamiltonhealthsciences.ca/share/stem-cell-legacy/?utm_source=HHS+Share+internal&utm_campaign=451b0b4286-EMAIL_CAMPAIGN_2018_08_08_05_40_COPY_02&utm_medium=email&utm_term=0_809360066d-451b0b4286-72370613](https://www.hamiltonhealthsciences.ca/share/stem-cell-legacy/?utm_source=HHS+Share+internal&utm_campaign=451b0b4286-EMAIL_CAMPAIGN_2018_08_08_05_40_COPY_02&utm_medium=email&utm_term=0_809360066d-451b0b4286-72370613)

Recently, **Kelly Lightfoot**, a MLT in the HRLMP RCD laboratory, was interviewed on the topic of:  
**Mindfulness: Live in the moment**

Click on the link below to read the full article and Kelly’s helpful tips:  
Congratulations to our Anticoagulant team at St. Joseph’s Healthcare Hamilton, who were recently awarded the ACE certificate.

The Centre of Excellence program is awarded to health care institutions providing high quality anticoagulant care while conforming to processes, standards, and evidence based guidelines.

St. Joseph’s is the first hospital in Canada to achieve the Anticoagulation Forum Centre of Excellence designation.

News from Pathology

Congratulations to Dr. Cathy Ross, as she accepts the office of President, Canadian Association of Pathologists (CAP-ACP).

Welcome to Dr. Clinton Campbell, our new hematopathologist located at the Juravinski site.

Dr. Campbell completed a PhD and Medical school at McMaster before doing a residency in hematopathology in Halifax.

He comes to us from Princess Margaret Hospital and is developing his academic and research
interest in areas of myeloid stem cells and artificial intelligence.

We would also like to welcome Dr. Mary Anne Bret.

Dr. Bret completed her residency in Anatomic Pathology here at McMaster.

She has recently completed a fellowship in both gynecologic pathology as well as cardiac pathology and is now situated at the Hamilton General site.

Welcome back Dr. Bret!

Quality News

We would like to say thank you and all the best to Robin Dewit.

Robin has been the HRLMP CQI Coach since February 2019 and has been instrumental in rolling out quality improvements throughout the laboratories.

Robin’s last day with the HRLMP was August 22, 2019.

Research News

Please consider participating in and supporting the upcoming Strides for the General.

This event in support of the Hamilton General is being held September 14, 2019 at Bayfront Park.

Click on the link below to read testimonials in support of the great work Strides for the General supports:
http://events.hamiltonhealth.ca/site/PageNavigator/TR1930/TR1930_reus_DIY_Ambassadors.html

Click on the link below for further information and registration details for this event:
http://events.hamiltonhealth.ca/site/TR?fr_id=1930&pg=entry

Register before August 31 for early-bird pricing!

Below is a link to a write up of the highlights of the results from a major study, the PAUSE Study, offering insights into making surgery safer in patients taking direct oral anticoagulants (DOACs).
**Lab Connections**

**Dr. J. Douketis** was the primary investigator for this international study and the HRLMP’s Special Coagulation laboratory ran the assays for this study.

Click on either link below for the full story:


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Please consider heading out to Dyments Farm on October 4, 2019 and joining in for an illuminated walk through farmland fields, enjoy food and entertainment and fun fall activities.

**Illuminight** is a very special evening in support of the Cancer Program at Hamilton Health Sciences Juravinski Hospital and Cancer Centre.

Click on the link below for further information and registration details: