Orthopaedic Residency Training
Program
Edmonton, Alberta

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OVERVIEW OF THE RESIDENCY TRAINING PROGRAM

The goal of the Orthopaedic Surgery Residency Training Program at the University of Alberta is to produce a well-rounded Orthopaedic surgeon. We aim to provide a complete educational experience in both research and clinical Orthopaedics with a proper mix of academic knowledge, operating room experience and outpatient experience. Traditionally, the Orthopaedic Residency Program at the University of Alberta has been rated highly not only by resident satisfaction but also success rate on examinations and ease of placement of successfully trained Orthopaedic Surgeons post-fellowship.

Each year in January we select the new PGY1’s and at the present time we have three funded positions per year. The selection process is designed to consider any candidate who possesses the attributes necessary to become an Orthopaedic surgeon, regardless of location of earlier training in Canada. Successful applicants to the program initially start in the Core Surgery Program under the directorship of Dr. Ken Stewart. This Core Year is useful to develop both the academic knowledge and clinical skills necessary to becoming a surgeon. During the course of the year there is a seminar series covering topics necessary to master for the Principles of Surgery (POS) exam. Animal labs are available to practice basic surgical techniques, in addition to Pediatric Advanced Life Support (PALS) and Advanced Trauma Life Support (ATLS) courses. The PGY1 rotation includes: twelve weeks of General Surgery, eight weeks of Medicine, eight weeks of Emergency Medicine, four weeks of Pediatric Surgery, four weeks of Coronary Care, twelve weeks of Orthopaedics and four weeks of vacation.

In PGY2, although this is technically part of the core training as described by the Royal College, the Program Director of Orthopaedic Surgery is directly responsible for the second year. This year includes six months of Orthopaedics, one month of Thoracic/Vascular Surgery, two months of ICU, one month of Plastic Surgery, one month of Neurosurgery and one month of Diagnostic Imaging. It is important to realize that during the PGY2 year residents are encouraged to sit the Principles of Surgery (POS) exam and therefore further reading will be necessary in this area to ensure that this exam is passed.

In PGY3, 4 and 5 there are no off-service rotations but there are twelve compulsory three-month rotations. These are described in more detail later in this handout. To summarize, there are eight rotations covering each aspect of subspecialty Orthopaedics, three months of elective, three three-month chief residency rotations and a six-month block of Pediatric Orthopaedics.

Royal College fellowship exams will be held in May and June at the end of the final PGY5 rotation. The written exams are held towards the middle of May at the various sites across Canada and the orals are held in the first part of June in Ottawa. Exam preparation sessions will be held for all PGY5 residents.

MANDATORY ORTHOPAEDIC ROTATIONS

PGY 1
Introduction to Orthopaedics—2 months adult, 1 month pediatric

Junior resident rotations (PGY 2 & 3)
- Trauma 3 months
- Arthroplasty 3 months
- Paediatrics 3 months
- Upper extremity 3 months
Senior resident rotations (PGY 4 & 5)
  Pediatrics 6 months
  Chief resident 6 months
  Elective 3 months
  Ambulatory care 3 months
  Sports medicine 3 months
  Oncology 3 months

RESIDENCY TRAINING COMMITTEE

This committee is responsible for the development and operation of the program including:
  1. Clinical rotations
  2. Resident evaluation and promotion
  3. Teaching sessions and seminars
  4. Visiting professors
  5. Selecting new residents
  6. Allocating funds to resident travel, books etc.
  7. Hearing appeals of evaluations
  8. Supervision of research projects.

The members of the committee include:
  1. Program Director (chairman)
  2. Divisional Director
  3. Member of the research committee
  4. Co-ordinator of Family Medicine rotation
  5. Teaching coordinator from University Hospital
  6. Teaching coordinator from Royal Alexandra Hospital
  7. Teaching coordinator for Caritas Hospitals
  8. Resident representatives from each of PGY years 1 to 5

The committee meets quarterly or at the call of the chair. The meetings are open to all residents and orthopaedic surgeons.

HOLIDAYS

Residents are allowed 4 weeks holiday and days off in lieu of statutory holidays worked as per the PAIRA contract. Residents are strongly encouraged to attend the AO basic and advanced courses, COA basic science course and an orthopaedic review course prior to the RCPSC examinations. There is no specific time allowed for course attendance but it is expected that residents away for educational reasons will ensure that there is adequate manpower to cover for them. Industry sponsored conferences can be attended if the Program Director has approved the content or if holiday time is used to attend. Residents are eligible for some funding each year for educational travel. At the present time, the Division funds the following courses:
  - Basic AO course/OTA meeting for junior residents
  - Basic Science Course, Ottawa
  - Ste. Justine Pediatric Course, Montreal
- Calgary Orthopaedic Review Course
- American Academy Resident Arthroscopy Course

In addition, any resident presenting a paper at a national meeting will receive some financial support.

**ELECTIVES**

Provisions are made into the rotation schedule for a three-month elective in the PGY4 year. This elective period can be in any Orthopaedic field subject to the approval of the program director. Residents will continue to receive their salary from the University of Alberta. Living expenses are the responsibility of the resident. If the elective is to be taken out of the province, then it is necessary to contact the Office of Surgical Education and the Postgraduate Medical Education office well in advance (at least six months) so that liability coverage and an educational license can be arranged.

**RESEARCH**

In order to meet Royal College requirements, research is a compulsory part of the residency program. In PGY1, residents are expected to complete a literature review. Residents in PGY2 - 4 are required to complete a total of two research projects for presentation at the annual Alberta Orthopaedic Resident Research Day which alternates between Edmonton and Calgary. There are projects already in progress in which junior residents can participate. Senior residents will often work independently. It is strongly encouraged that the completed project be submitted for publication. At present, research is being carried out in the fields of sports medicine, spinal deformities, cartilage preservation, stem cell research and knee biomechanics. The Division of Orthopaedic Surgery has alliances with the Department of Anatomy and the Faculty of Engineering. There is no formal rotation dedicated for research but time is allotted during the academic half day, particularly during the summer months. L. Beaupre, N Jomha and VJ Raso coordinate the research program.

**ACADEMIC PROGRAM**

1. **Academic half-day:** This is held every Wednesday afternoon. There is a seminar schedule based on a core curriculum which cycles every two years. During the five year residency each resident should have been exposed to the core topics at least twice.
2. **Anatomy sessions:** These are held in the anatomy lab during the summer months. Cadavers are used to demonstrate surgical approaches.
3. **Fracture rounds:** Held Tuesday afternoons at both the Royal Alexandra and University Hospitals
4. **Arthroplasty rounds:** Held Thursday afternoons at the Royal Alexandra Hospital
5. **Grand rounds:** Held every Friday morning from September to June
6. **Paediatric rounds:** Held every Wednesday
CALL

At the present time, there is a senior and junior resident on call at both the UAH and RAH. Residents will not be expected to take call more than one-in-four. As there are insufficient numbers of residents some call is covered by paid resident replacements. The two residents on call will be expected to work as a team. The junior residents will take call “in house”. They will be called to see all consultations from the Emergency Department (ED) and will assess the patient and discuss a treatment plan with the senior resident. They will perform reductions and other minor procedures in the ER. They will also deal with medical problems arising with in-patients. The senior residents will provide back up call and will be available to assist the junior residents. They are able to take second call from home. The senior residents will be involved in assisting in the operating room for emergency surgery. This “job description” is meant to be flexible and it is expected that roles will shift depending upon workload. PGY 1 and 2 residents will take junior call and PGY 3 and 4 residents will take senior call. Ideally PGY 3 residents will take senior call, but there may be occasions when they may be required to take some junior call. This graded responsibility is an important concept of residency education. In the PGY 5 year, there is no formal call but the residents are expected to act as “chiefs” whether on adult or pediatric orthopaedics. They are expected to be available at all times unless away from the city to assist in the OR and act as a consultant for difficult or unusual case.

OBJECTIVES OF TRAINING

The Royal College of Physicians and Surgeons of Canada redefined the scope of specialty training. A new skill set for specialists in the new millennium was developed under the name of CanMEDS 2000. This has now been revamped to CanMeds 2005 framework. Residency programs are now required to produce goals and objectives in a form that encompasses CanMEDS competencies. The skill set is as follows:

1. Medical expert
2. Communicator
3. Collaborator
4. Manager
5. Health advocate
6. Scholar
7. Professional

The rotation specific objectives are intended to augment but not replace the “Objectives of Training and Specialty Training Requirements in Orthopaedic Surgery” as established by the Royal College.

EVALUATION

Each resident in years PGY2-5 are required to write the Orthopaedic In-training Examination (OITE) from the American Academy of Orthopaedic Surgeons. This is held each year in November. The marks are scaled and the resident is given an indication of his performance in relation to others at the same level of training.
Twice a year, oral examinations will also be held. The format is very similar to the Royal College examinations and the residents are scored in a similar manner. As oral examinations are unfamiliar to most residents, this is an important exercise in order to familiarize residents with the “examsmanship” necessary to succeed at this type of examination.

Preceptors will evaluate residents at the mid-point and at the end of each three-month rotation, based upon the rotation specific objectives. In addition, residents will be expected to evaluate their preceptors. Residents are also evaluated by nursing staff and other health professionals at the University and Royal Alexandra sites.

**Appeals**

The appeal process follows the following steps:

1. Discuss the evaluation with the preceptor and the program director.
2. Appeal to the residency training program committee.
3. Appeal to assistant dean, postgraduate medical education

If there is no consensus at this point then the appeals policy of the University of Alberta will be followed.

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**WEB ONE45**

The Faculty of Medicine and Dentistry has signed a software license agreement with One45 for their WebEval Software for a five-year term. This agreement incorporates all undergraduate medical students and postgraduate residents and the software will allow us to move away from paper based evaluation forms and transcription of written comments, to that of an electronic web based system with a central database. Access to this system is over a secure link to the Internet with user name and password protection. For all new residents to the program, the Orthopaedic Residency Office will send an e-mail to you that allows you to log-on to the system and access your information. Once you are logged-on to the system you can access your rotation schedule, send evaluations to preceptors, respond to evaluations of rotation/preceptors and track activities that you have completed.

Significance Statement
The Royal College of Physicians and Surgeons of Canada General Standards of Accreditation states that “the academic and scholarly aspects of research training must be commensurate with the concept of a University’s post-graduate education”.

Unique Features
The Royal College General Standards statement also includes several unique features of research training relevant to clinical post-graduate trainees. They state that “residents must be given the opportunity to develop effective teaching and communication skills by means of teaching colleagues and students, conference presentations, clinical and scientific reports, and patient education”.

The other unique feature of research training for clinical post-graduate students is that it fosters development of critical appraisal skills, which are essential for ongoing clinical development and self-education and are necessary skills for dealing with change. The Department of Surgery has a research-training environment that provides a unique opportunity for residents to develop these skills. Furthermore, good research skills have a positive impact on practicing clinicians continuing medical education and promote the “life-long learner” concept emphasized within the Royal College.

Expectations of the Residents
By the end of the Residency Training Program, the resident will be able to:

1. Conduct a thorough literature review using texts, journals and a computerized database.
2. Evaluate an article from the scientific literature using these criteria:
   a) relevance of the topic to current practice
   b) significance of the topic to current surgical research
   c) adequacy of the methodology
3. Design and execute - in conjunction with a research supervisor - a research project by:
   a) conducting a literature review on a given topic including calculation of appropriate sample size for selected articles (PGY 1),
   b) developing and proposing a study design to meet a stated objective (PGY 2),
   c) taking a proposed study through a formal ethics review process (PGY 2-3),
   d) conducting and presenting a full study (PGY 3, 4), and
   e) writing and submitting an article on the study to a peer-reviewed journal (PGY 3,4,5).

A positive attitude towards continuing education, clinical and research collaboration, and independent execution of research projects is an important goal of the research training experience. We encourage a positive outlook towards the research training experience and want to know if residents have concerns about this aspect of the program.

Conditions of Learning
The Guidelines of the Royal College General Standards of Accreditation encourage residents to participate in clinical research during all levels of the course of the residency program. Clinical research is defined as research involving human subjects or experimental studies of direct clinical relevance. Acceptable clinical research may include:
- Analysis of a contemporary clinical problem, using acceptable research methods the results of which are reported to a local or national meeting and are eligible for publication in scientific journals, or
- Supervised participation in an ongoing experimental research project.

Residents in the early years are expected to develop a scientific approach to problems within their discipline. This consists of a literature review that addresses a given problem, discussion with key research mentors, and posing a hypothesis for study in the following year. More senior residents are expected to formulate and initiate a research study that includes ethics approval.

**Methods of Instruction**

Instruction on research methods will be part of the academic half day over a two-year cycle. Topics to be addressed and possible speakers are listed below:

- Reviewing the literature (See Text by Greenhalgh, Jeanette Buckingham)
- Research Methods: study design and statistical analysis (Alyson Jones)
- Clinical Research and multi-centered trials (Lauren Beaupre)
- Basic Science Research (Keith Bagnall)
- Epidemiology (Alyson Jones)
- Presentations and Publications (David Cook?)
- Research Ethics (Judith Abbot/Morish)

Instruction will also be received from the principal investigators of the various research groups. The Research Committee will conduct review and evaluation of the research. Residents will meet with the Committee quarterly to review overall progress and more frequently during completion of the annual research project. This document concludes with an outline of research methods pertinent to orthopaedics.

**Major Research Groups and principal orthopaedic investigators:**

1. Upper extremity: Dr. R Balyk
2. Ligament reconstruction: Dr. D Otto
3. Total Joint Replacement: Drs. W Johnston, Cinats, etc (Contact: L Beaupre)
4. Spinal Research Group: Drs. M Moreau, J Mahood (Contact: K Bagnall and J Raso)
5. Sports Medicine: Dr. D Reid
6. Trauma: Dr. D Weber
7. Cartilage Preservation: Dr. N Jomha

By the conclusion of the residency program, many residents will have completed a body of work sufficient for a Master’s degree. It is possible for a resident who is interested in pursuing a career in an academic setting to complete a Master’s or PhD degree in conjunction with their orthopaedic training. The key to this track is to identify your interest as early as possible so that an appropriate program can be put in place.
RESEARCH METHODS IN ORTHOPAEDIC SURGERY

The following sections provide more detail for broad research areas listed above.

PROBLEM IDENTIFICATION
The research cycle begins with the identification of a problem. This may be a clinical result that does not follow the course described by your colleagues, it may be void in understanding the pathomechanisms or even the normal behaviour of some aspect of the muscular skeletal system or it may be a treatment regime that does not produce the expected result. You will find that any orthopaedic dogma if probed, to a sufficient depth will be lacking in some essential understanding. Successful research is based on identifying an important problem and asking the right questions. An essential point in the scientific method used to conduct orthopaedic research is to state a hypothesis, ie the answer to the question, before proceeding with the study. This helps to ensure that the study is properly formulated at the outset and adds considerable weight to statistical analysis of the data. One could argue that without a preset hypothesis, much of the statistical analysis that is done becomes meaningless.

PGY I and II residents will be given the research problem. In PGY I, it will be posed as a question to be answered by searching the literature. PGY II residents will formulate together with a research mentor a hypothesis based on the literature review from the previous year. PGY III and IV residents may pose a hypothesis of their own or in collaboration with someone involved in a particular research area.

LITERATURE REVIEW
There are specific issues that every scientific article should address. How well these issues are described should increase the confidence of the reader in the final conclusions of the article.

The methods section is the first section that the reader should study before proceeding to the results or discussion - it is often one that is not read at all. There should be sufficient detail that the study could be replicated if desired. This section should convince you that as proposed, the study would meet the stated objective. Consider each issue listed below:

- a clear problem statement provides the focus of the study
- a hypothesis relevant to the stated problem
- the most relevant variables are studied
- appropriate subject selection
- valid measurement techniques
- reliable and repeatable data
- appropriate study design and data analysis
- findings are based on the data
- bias is identified
- adequate discussion
- conclusions based on results of study
- generalizability of conclusions
RESEARCH DESIGN
The aim of most research studies is centered on one of the following.

1. Testing the efficacy of conservative or surgical treatments or other interventions. The randomized control trial is the preferred study design. The advantages of this approach are:
   (i) allows rigorous evaluation of a single variable in a well defined group;
   (ii) it is prospective, ie you see what happens after you define your study;
   (iii) it uses a null hypothesis approach; and
   (iv) minimizes bias.
Randomized control trials are expensive and time consuming, resulting in too few subjects or for too short a time or use of surrogate end points rather than clinically relevant points. Hidden biases may also be introduced, through imperfect randomization or failure to blind the assessors.

2. Testing the validity and reliability of a test (i.e. does the test measure what we want to measure and do we get the same results every time). This is best done using a cross sectional survey in which both the new test and a standard test are applied. In this approach a representative sample of subjects are examined at a particular time to answer a specific clinical question. A cross sectional survey can also be used to demonstrate the value of a screening test applied to a large population.

3. A longitudinal cohort study is used to study the prognosis of a disease detected at an early stage. Groups of people are selected based on their differences and followed to determine how many in each group develop a distinct outcome. Randomized control trials are often done on patients - people who have a disease - while cohort studies are performed on subjects - people who may or may not produce a specified outcome. These studies require long follow up, typically years or decades.

4. Cohort or case-control methods are used to determine if a particular agent is the cause of an illness. Case control studies compare patients with a condition with matched controls. A particular problem with case control studies is the definition of cases for inclusion. Errors in assigning patients can significantly affect the results of the study. Note: this approach can not establish a cause, it can only demonstrate a correlation.

5. If the illness is particularly rare, case reports may provide important information. Cases can be combined to provide case series of similar patients to highlight a particular aspect of a disease or outcome. Although often considered weak science, case reports can convey important and useful data in an easily understood format.

STATISTICAL ANALYSIS
Table 1 lists some commonly used statistical tests for particular research purposes. The first column of the table lists reasons for completing a statistical test. ‘Independent’ samples are those that are considered to be the initiating factors in the study. Observations that arise out of these independent factors are termed dependent variables. The second and third columns of the table list the specific statistical test to be used depending on the type of data. Parametric tests are used with continuous data, eg, heights, weights, etc. Non parametric tests are used with data that is not continuous, eg hair color, sex, etc.

Points to consider when reviewing the statistical aspects of your study:

A. Set the scene:
   • show that groups are comparable and that you have adjusted for baseline differences,
   • describe the data and the appropriate statistical tests you will use,
   • if you need to use obscure tests, explain why, and
   • analyze the data according to the protocol you intend to use.
B. When dealing with paired data and outliers:
   • perform paired tests on paired data,
   • use a two tailed test unless you can show that a one tailed test is sufficient, and
   • describe the outliers and how you dealt with them.

C. For correlation, regression, and causation analysis:
   • be aware that correlation and regression differ, calculate the correlation coefficient, r^2 and consider its meaning in the context of your study
   • be clear about the assumptions you are making about causation, ie independent versus dependent variables.

D. When presenting your probability and confidence tests:
   • describe how you set the p values for your tests
   • calculate the confidence intervals and ensure they support your conclusions.

It may be that you have found a statistically significant difference but you should show that the difference is clinically meaningful. This may require setting out at the beginning of the study a definition of a result that is clinically significant.

Table 1: Common Statistical Tests

<table>
<thead>
<tr>
<th>Purpose of the test</th>
<th>Parametric Test</th>
<th>Non Parametric Test</th>
</tr>
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<tbody>
<tr>
<td>1. to compare 2 independent samples from the same population</td>
<td>unpaired t test</td>
<td>Mann-Whitney U test</td>
</tr>
<tr>
<td>2. to compare 2 sets of observations on a single sample</td>
<td>paired t test</td>
<td>Wilcoxon matched pairs test</td>
</tr>
<tr>
<td>3. to compare 3 or more sets of observations on a single sample</td>
<td>one way analysis of variance (F test using total sum of squares)</td>
<td>Kruskall-Wallis analysis of variance by ranks</td>
</tr>
<tr>
<td>4. to examine the influence and interactions of co-variables with multiple observations on a single sample</td>
<td>two way analysis of variance</td>
<td>two way analysis of variance with ranks</td>
</tr>
<tr>
<td>5. to test the null hypothesis that the proportions of discontinuous variables estimated from two or more independent samples are the same</td>
<td>no method</td>
<td>chi squared test</td>
</tr>
<tr>
<td>6. to describe the quantitative relationship between two variables</td>
<td>regression by least squares</td>
<td>no method</td>
</tr>
</tbody>
</table>

ETHICAL CONSIDERATIONS – (See section 2)
By its very nature, research requires the introduction of novel treatments or diagnostic procedures. In so doing, subjects are recruited into experiments with unknown outcomes. They have every right to know the risk associated with their involvement and to chose the extent of their participation in these experiments. Ethic review boards have been established in academic settings to ensure that these rights are respected. To ignore or circumvent these established procedures may leave you open to legal penalties and censure from the Royal College.
A GUIDE FOR THE ANALYSIS OF ORTHOPAEDIC LITERATURE

Review the objective/hypothesis, methods and materials, results and conclusions sections only. Consider the following aspects of each paper:

Construct Validity - how well was the basis for the research described
  i) Description of cause and effect variables and their measures;
  ii) Cause variables clearly separate from effect variables;
  iii) Observer was independent, eg blinded to status of subjects

External Validity - can the results of the study can be generalized
  i) To all types to all those with the condition;
  ii) To other settings;
  iii) If a laboratory or animal study, can the results be applied directly to humans

Internal Validity - was the protocol applied consistently
  i) Changes in the subject characteristics affect results, (e.i. maturation)
  ii) Results affected by selection of subjects
  iii) Appropriate controls
  iv) Results affected by subjects dropping out of study
  v) Retrospective or x-sectional study limits separation of cause and effect

Statistical Analysis of Results
  i) Appropriate use of statistics
  ii) Appropriate application of multiple analysis
  iii) Large errors in the outcome or dependent variables
  iv) Errors in experimental set up
  v) Large variation in the control or subject group