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Densitometry and Video-microscopy

Robert M. Bernstein, MD *New York, New York*;
William R. Rassman, MD *Los Angeles, California*

In evaluating a person with androgenetic alopecia for a hair transplant, typically the physician determines the patient's Norwood Class, designs a hairline, delineates the extent of coverage, "eyeballs" the donor area, and then decides upon the appropriate number of grafts. Taking specific measurements of hair density and donor miniaturization are not routinely performed. However, donor density and miniaturization are important variables in deciding which patients are good candidates for hair transplantation and are useful in determining how many grafts are needed in the procedure.

Densitometry is a technique that analyzes the scalp under high-power magnification to give information on hair density, follicular unit composition, and degree of miniaturization.

It can be used to help evaluate a patient's candidacy for hair transplantation and help predict future hair loss. More recently, video-microscopes have been developed that can project the image onto a computer screen and provide a permanent digital record. This paper describes the value of taking objective measurements, using densitometry or video-microscopy, in the hair transplant evaluation.



Figure 1. Hair Densitometer

Background

One of the earliest methods of measuring hair density was devised by Bouhanna, who used camera attachments to create a "phototrichogram," an ultra close-up photograph of hair exiting the scalp. This method provided the capability to document the quality and quantity of hair shafts. However, the disadvantage of this innovation was that an assessment could not be done until after the film had been developed.¹

In 1993, Rassman introduced a small hand-held instrument, the Hair Densitometer, to make densitometry easy to perform during a consultation.^{2,3} The hair densitometer is a self-contained, portable, device that houses a magnifying lens and an opening of predetermined size (Figure 1). The hair is clipped short (~ 1 mm) and the unit is placed directly on the scalp. An assessment is made from a standard 10mm² field. Multiple measurements taken from different parts of the scalp are often helpful, particularly if there is significant variability from one location to another.⁴ An advantage of the hand-held densitometer is that it is inexpensive and readily available to be used during the consultation and can provide immediate information regarding a patient's candidacy for surgery.

A number of other hand-held instruments to measure density have been developed with the similar basic elements of magnification, illumination and a calibrated field or ruler. With more



Figure 2. Micro-VID Digital Hand Held Microscope

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Odds are
you won't want to miss the
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President's Message

Paul C. Cotterill, MD Toronto, Ontario, Canada

I was sitting in an airplane recently biding my time reading one of the latest spy novels, copyright 2005, and came upon a passage that described how the hero, an upscale, brilliant secret agent described another man, the bad guy. In addition to being described as expensively dressed, dangerous, and untrustworthy, the agent also goes into detail to describe the neat rows of symmetrical plugs that look like a doll's head. This representation of plugs on the bad guy, of course, perpetuates the often poor image of transplants that we're all actively trying to dispel.



Paul C. Cotterill, MD

Other examples I have come across recently of outdated or inaccurate information include an article from *Forbes* on the most popular plastic surgery for men, which has an old photograph, courtesy of a plastic surgery society, that depicts old style, big plugs in corn rows, balloon expanders, and inverted Y reductions. Another example from *USA Today* reported 2005 estimates from the American Society of Plastic Surgery (ASPS) that 39,244 men had hair transplant surgery. I responded in a letter to the editor of *USA Today* citing the ISHRS 2005 practice census by Leever Research that showed 168,155 hair transplants were performed worldwide in 2004, of which 87,987 were performed in the U.S. When one factors out female and non-scalp transplants, one is still left with an estimate of 74,963 transplants for men in 2004. This is almost twice the ASPS estimates from 2005. I went on to take the opportunity to tell the *USA Today* editor that the ISHRS is the leading medical authority on hair loss and hair restoration and encouraged him to contact the ISHRS or visit our website if any further information in the future is required.

The perpetuation of poor images of transplantation or a lack of knowledge of what can be achieved with today's evolved techniques is all too common. How can you individually and we, the ISHRS, combat this? Some suggestions: 1. Educate our friends, colleagues, and acquaintances whenever we can of who we are and what we do. 2. If you see instances of incorrect or out-of-date hair data, respond to it personally, refer them to www.ISHRS.org, or contact me directly. The ISHRS has a public relations/media spokesperson, Karen Sideris, who can deal with these issues as they arise. 3. The ISHRS has as one of its most important strategic initiatives to increase public awareness of HRS. However, it takes money to get this message out, and we're not a huge, wealthy society. I am also concerned that any money the ISHRS spends on PR should be to enhance not just the reputation and visibility of our North American members but our international members as well. Wherever we can, we are trying to get the good word out. And I would ask that each of you endeavor to do the same. 4. The Hair Foundation, established in March 2006, in no small part thanks to the huge efforts of Dr. Tony Mangubat, is envisioned to do what the ISHRS can't in terms of PR. By bringing together the various facets of the hair industry, and with it the valuable dollars needed to promote hair health, there will be the added benefit of elevating the reputation of the ISHRS as a leader in hair knowledge and hair restoration. So the next time the media or the interested public wants up-to-date information regarding the hair restoration industry, it will be the ISHRS that people will think of first and go to for accurate information. We need to be number one. 5. Consider supporting the Annual Giving Fund. Money raised by your generous contributions, which goes to support many different educational programs and initiatives, will go a long way to raising the credibility and presence of the ISHRS.

These are all lofty goals I'm sure, but perhaps someday, when I read another spy novel, it will be the hero, the good guy, that has the undetectable, totally natural appearing hair transplant and not the bad guy.

Paul C. Cotterill, MD
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Co-Editors' Messages

Jerry E. Cooley, MD *Charlotte, North Carolina*



Jerry E. Cooley, MD

Ponder this quote: "As we know, there are known knowns. There are things we know we know. We also know there are known unknowns. That is to say, we know there are some things we do not know. But there are also unknown unknowns, the ones we don't know we don't know."

A recently ousted politician made this statement in answer to a reporter's question. I like it because of the state of mind I've been in recently. I've been thinking a lot about how much I don't know when it comes to hair restoration. Despite growing surgical experience and ever better results, I'm less certain about a lot of things, compared to five or ten years ago. I feel like I should be much more sure of myself and what I know compared to the way I felt in the past.

I was getting kind of worried about this until I ran into a colleague of mine at a recent hair get together. He is a world-renown surgeon, one of the very best. Without saying anything to him about the way I had been feeling, he confided in me that he had recently been full of uncertainty. He was currently reevaluating all aspects of his technique because of so many things he was becoming "unconvinced" about.

If I had to sum it up, I couldn't say it any better than this: There are things I know, things I know I don't know, and things I don't even know I don't know. I know that intact grafts grow better than damaged ones. I know that blood supply and oxygen are important for graft growth. I know that preserving existing hair with medical treatment is essential. I know that future hair loss must be considered when making a surgical plan.

But there are many things that I know I don't know. I'm not sure whether sutures or staples are best for the donor, and if sutures, which kind? I'm not sure whether I should use parallel or perpendicular slits, despite comparing both for almost ten years now. I don't know what the best holding solution is for grafts. I don't know what the best post-op care program is for the grafted area. I'm not as certain as I used to be about hairline design, whether it's always better to be conservative. I'm not sure why some people get better results than others.

And, of course, there are the things I don't even know that I don't know including????!!!! But maybe a little uncertainty isn't such a bad thing. It keeps you vigilant, always looking for evidence to support what you do. It also keeps you humble, realizing that today's state of the art will be considered primitive or just plain wrong in the future. But what do I know?

Jerry Cooley, MD

Robert S. Haber, MD *Cleveland, Ohio*



Robert S. Haber, MD

I'm concerned about the health of our field. At present, everything seems fine. Our meetings are better than ever. Our surgical results are outstanding. Our concern about scientific validity in our research and reports is genuine. And our Society, well into its second decade, is viable, relevant, and in capable hands. My concerns do not focus on the present though, but rather the future. Our future

depends on continued growth of our Society and our field. If indeed we are doing the good job we think we are, then more patients should be undergoing hair restoration each year. And in response to this growth, more surgeons should be entering the field, and of course joining the ISHRS. We should have expected therefore an increase in our membership of perhaps several hundred over the past decade. And yet our membership has been stagnant during that time. This is worrisome, for if we don't add new members, then as our current members age and retire, the entire field could wither.

It's well known that a reverse law of supply and demand works in medicine, whereby the more surgeons available to provide a procedure, the more those procedures are performed. So the long sought answer to the dilemma of increasing the number of procedures performed each year might simply lie in successfully recruiting more surgeons.

Why has this been so elusive? Firstly, we really don't know where to look. The two "traditional" pathways into

hair restoration are via Dermatology and Plastic Surgery, two specialties that include extensive training in cosmetic procedures. These then are the logical specialties to focus upon in recruiting new members. Yet if the interest shown at the American Academy of Dermatology (AAD) annual meeting is an indication, that focus will yield disappointing numbers.

A decade ago, the Hair Transplant Symposium at the annual meeting of the AAD was packed with hundreds of people, many who subsequently chose to further develop an expertise in hair restoration. Yet over the following years, even as our field matured and our results improved, interest seemed to wane. The large Hair Transplant Symposium was replaced with smaller format offerings. A few years ago, I counted just 25 people in the largest hair transplant lecture at the AAD. That number grew to over 100 briefly, yet in Washington, D.C., this year, the number again was disappointingly small.

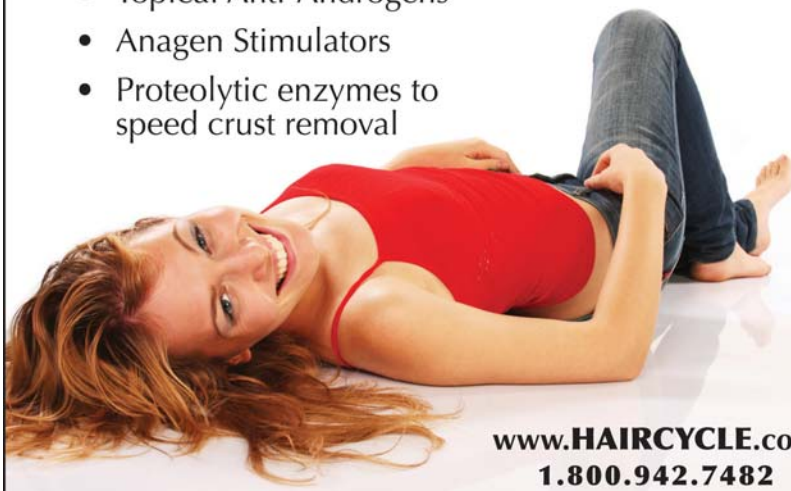
If we can't generate interest within the traditional core, where should we look? "Non-traditional" pathways lead from many specialties, but although some of our finest surgeons began in emergency medicine or a variety of surgical specialties, it's impractical to target those specialties for our next generation.

Must we simply sit back and wait for new members to trickle in? Or can we find ways to reach residents and other young physicians and introduce them to our field? There is no easy answer to this dilemma, but clearly we must all work at a solution.

Bob Haber, MD

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Please send all submissions and author consent release forms electronically via e-mail. Remember to include all photos and figures referred to in your article as separate attachments (JPEG, Tiff, or Bitmap). Be sure to ATTACH your file(s)—DO NOT embed them in the e-mail itself.

An Author Consent Release Form must accompany ALL submissions.

The form can be obtained in the Members Only section of the ISHRS website, under the section "Forum Newsletter," at <http://www.ishrs.org/members/member-index.php>.

Send article AND release form to:

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E-mail: HaberForum@aol.com

Submission deadline:
May/June, April 10

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Notes from the Editor Emeritus

Dow B. Stough, MD *Hot Springs, Arkansas (Forum Editor 1999–2002)*



Dow Stough, MD

Doctor, what is your lifetime risk of occupational viral exposure?

It started as a conversation among colleagues regarding a young HIV patient requesting hair transplantation. Not an unusual request. Most hair transplant surgeons routinely transplant both Hepatitis and HIV positive patients. The discussion that followed involved speculation on the legal ramifications of accepting or rejecting such a patient. This was followed by conversations regarding one's technical staff, that is, Can staff be expected to work on patients that may pose a health risk to themselves? or Should pregnant staff members assist with Hepatitis–HIV cases? This brief exchange triggered a series of events that resulted in a great deal of research and composition for this Editor Emeritus article and a glimpse into this complex subject. A list of highly recommend reading sources can be found in Table 1.

Standard of Care

Suffice it to say, there is no standard of care regarding the legal obligation of one's staff to perform an elective procedure. We have worked on both Hepatitis and HIV positive patients and will continue to do so. Problems arise when the majority of supporting staff are pregnant and do not want to take a risk of exposure to their babies. As research for this column, I contacted our local State Board of Medicine and was advised we could not deny treatment to a patient regardless of their status (the medical board was considering non-elective surgery). The board's position was also that a physician cannot coerce staff members to work on patients they are uncomfortable with due to race, creed, or health status. Surgeons cannot operate without proper staffing, thus cases can be rejected on the grounds of inadequate staffing.

dex, known as the ICR, and is calculated in the following manner:

$$\text{ICR} = 1 - [1 - (\text{seroprevalence of virus} \times \text{seroconversion rate})]^{\text{number of skin injuries per year} \times \text{number of years of practice}}$$

Simply stated, surgeons have a higher risk of injury than other healthcare professions. Where there are high levels of viral infections in the population served, there are more injuries over time, and therefore the equation generates higher levels of individual risk. The Bandolier report provides a simple mathematical equation to calculate one's lifetime risk.

Let's look at some specific examples. In a population in which the seroprevalence of HIV was 26% and the seroprevalence of HBV was 3%, the risk of infection following a single needlestick injury according to data for transmission can be calculated as follows:

HIV

For a single needle stick .08% (approximately 1 in 1,250)

The cumulative risk for a doctor by the end of two years as a student and a one year internship was calculated as 0.6% (1 in 1,600)

HBV

For a single needlestick 0.14% (with a population seroprevalence of 3%) (approximately 1 in 700)

The cumulative risk for a doctor by the end of two years as a student and a one year internship was calculated as 1% (1 in 100)

Table 1. Recommended Reading Sources

"Bandolier Extra," July 2003, Evidence-based health care	www.ebandolier.com
"NIOSH" Alert, January 2007	www.cdc.gov/niosh
"CCOHS," Canada's National Occupational Health & Safety Resource, January 2007	www.ccohs.ca/oshanswers/diseases/needlestick
"The Journal of Bone & Joint Surgery (Br)," January 2007	www.jbjs.org.uk
"HBV Antibody Testing: Indications and Interpretation," January 2007	www.hivandhepatitis.com/hiv
"Roenigk's Dermatologic Surgery: Current Techniques in Procedural Dermatology," Roenigk, et al., Third Edition; Informa Healthcare: NY, NY, 2007: Chpt. 12; pp. 107–108.	

Instead of spending countless hours debating legalities, our efforts may be better directed toward the understanding, education, and implementation of programs to reduce the lifetime risk of occupational viral infection to both the surgeon and his or her staff.

Lifetime Risk of Occupational Viral Infection (ICR)

A very extensive report by Bandolier, July 2003, is highly recommended reading for all transplant surgeons.

This report describes an Individual Cumulative Risk in-

Working Lifetime Risk

Additionally, the Bandolier report states that with a working lifetime estimate of 210 skin punctures, the individual cumulative risks were calculated to be 6.9% for Hepatitis C and 0.15% for HIV. For Hepatitis C, that is a 1 in 14 chance, and for HIV it is a 1 in 660 chance. The statistics for Hepatitis C are somewhat bothersome. Some populations, like drug addicts and prisoners, have high prevalence rates. Surgeons working with these populations have an increased risk.

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Editor Emeritus*continued from page 45*

A study was conducted in Italy that reported 20,000 occupational exposures. One in 100 workers with percutaneous exposure to HCV blood will be infected, as will 1 in 500 exposed to HIV infected blood (and with post-exposure prophylaxis). These are extremely high rates. The fact that this occurs, however, should not discourage us from transplanting patients who are HIV or Hepatitis positive. The odds are still small with an educated staff, adherence to universal precautions, and a population with low seroprevalence rates as shown in Table 2.

Table 2. Lifetime Risks—Fast Facts

- Needlestick injuries are common.
- Over a lifetime, the risk for an individual is finite and measurable. In some high-risk specialties, the risk is appreciable.
- The risk is dependent on the prevalence of the viruses in the population.
- The risk of infection after exposure to infected blood varies by bloodborne pathogen. The risk of transmission after exposure to HIV infected blood is about 0.3%, whereas it is estimated to be up to 100 times greater for Hepatitis B virus (30%) and could be as high as 10% for Hepatitis C virus.
- It is estimated that needlestick injuries involving blood contaminated with HIV can spread the virus in 0.3% of cases. Stated another way, 99.7% of needlestick/cut exposures do not lead to infection.
- Hollow bore needles with appreciable amounts of blood (and virus) carry the most risk.
- Prophylaxis and vaccination may help in some cases.

Needlestick Injuries

Hair transplant technicians and surgeons need to be aware of the risk for contracting HBV and HCV from needlestick injuries. The vast majority of occupational exposures to infectious agents occur through needlestick injuries (Table 2). HBV is more easily transmitted than HIV, and is one of the more common bloodborne pathogens among healthcare workers. The CDC approximates the probability of contracting HBV from a needlestick injury to be anywhere from 6–30%. It is estimated that approximately 100–200 healthcare workers die each year from HBV infection. Since a vaccine is available, it should be offered to all personnel at no charge.

Table 3. Exposure Recommendations

- Patient follow-up with HIV or Hepatitis exposure should be at least 6 months if not greater.
- The source patient and the staff should be tested upon exposure.
- In cases of HIV exposure, a CDC study found that healthcare workers who took postexposure prophylaxis were 79% less likely to become infected.

Antiviral Prophylaxis

A protocol should be developed for provision of a 24-hour immediate evaluation following exposure to a bloodborne pathogen. Prophylaxis and vaccination may help in some cases. Prophylaxis and vaccination may not prevent all infections, but one study showed that patients who seroconverted were less likely to have used Zidovudine (AZT) after exposure. Healthcare workers with needlestick injuries known to be contaminated with HIV infected blood should elect to begin a regimen of post-exposure prophylaxis as soon as possible after the injury. Generally, healthcare workers will take AZT or Lamivudine (3TC). A 1995 CDC study found that exposed healthcare workers who underwent this regimen were 79% less likely to become infected (Table 3). Post-exposure prophylaxis is a complex subject and the initial treatment is established by multiple factors. These include needle type, sta-

tus of the exposure source, the length of time between the exposure and the medical evaluation, and the health status of all involved parties. The use of post-exposure prophylaxis should be managed by specialists. These specialists often recommend two and three drug regimens. Proper counseling should be offered immediately for exposed healthcare personnel.

The Source Patient

One issue that needs resolution is guidelines concerning “source testing.” The Hepatitis-HIV status of the source of the needlestick injury is crucial in determining drug treatment. It is recommended that your office have the ability to determine the Hepatitis-HIV status of the source patient in the

event of an inadvertent exposure. If an informed consent has not been obtained prior to the inadvertent exposure, this may result in delay of the delivery of prophylaxis and add uncertainty to the counseling process and possible use of toxic and inexpensive drugs. Do not interpret the above as a recommendation for mandatory testing of HIV for all patients. This is not what I am advocating. Some surgeons believe routine preoperative Hepatitis-HIV testing of all patients reduces the risk to their staff (Table 4). Others feel this is not necessary. Regardless of your position, it is wise to be aware of your employee’s status. In the event of a mishap, this awareness is crucial in order to provide proper recommendations.

Operating on Immunosuppressed Patients

There is no supportive data in the literature stating patients with a decreased immune status from the HIV or Hepatitis virus are more susceptible to complications. A somewhat related article titled “Wound healing after implant surgery in HIV-positive patients” appeared in the *Journal of Bone & Joint Surgery (Br)*, January 2007. The authors performed a prospective, blind, controlled study on wound infection after implant surgery involving 41 procedures in patients infected with the human immunodeficiency virus (HIV) and 141 in HIV-negative patients. The patients were staged clinically and the CD4 cell count determined. Wound infection was assessed using the asepsis wound score. A risk category was allocated to account for pre-surgical contamination. In HIV positive patients, with no preoperative contamination, the incidence of wound infection (3.5%) was comparable with that of the HIV

Table 4. Problems with Routine Preoperative HIV–Hepatitis Testing

- A negative test result could falsely reassure your staff, because the source patient may have Hepatitis-HIV, but has not seroconverted.
- Should patients who refuse a Hepatitis-HIV test be denied elective surgery?
- Should HIV positive patients be refused nonessential operations for their own safety?
- Should patients insist on routine Hepatitis-HIV testing of medical and nursing staff?
- The best methods to gauge the overall health status of a Hepatitis or HIV positive patient are unknown.

negative group (5%; $p = 0.396$). The CD4 cell count did not affect the incidence of infection ($r = 0.16$). When there was preoperative contamination, the incidence of infection in HIV positive patients increased markedly (42%) compared with that in HIV negative patients (11%; $p = 0.084$). The results demonstrated that when no contamination has occurred, implant surgery (bone/joint) may be undertaken safely in HIV positive patients. Common sense would dictate that those with a low viral load and no concurrent infections should fare better than those in whose disease has progressed. One should carefully select patients that pose a low risk of complication and an increased chance for an excellent outcome.

Preventing Needlestick Injuries

What strategies can hair transplant surgeons utilize to minimize needlestick injuries in their office? Education and strict adherence to universal precautions is paramount in reducing one's lifetime risk of viral exposure. Proper waste management and utilization of safer devices relating to hollow bore needles is also absolutely essential.

The Bandolier report performed a systematic review of instances where a comprehensive program was undertaken. The results of these studies emphasize that there are no quick fixes. Some benefits can be immediately seen, but in the long run, as healthcare workers become "sold on the educational programs of needlestick reduction," the benefits will continue to accrue. Some valuable lessons to transplant surgeons would include instituting strict adherence to universal precautions emphasizing the need for all patients to be regarded as potential carriers of Hepatitis-HIV infection.

Written Exposure Plan

A written exposure control plan designed to eliminate or minimize worker exposure to bloodborne pathogens should be instituted. Compliance with universal precautions should be instituted even when you feel your staff already understands these principles. In my office we have a policy prohibiting bending, recapping, or removing contaminated needles and other sharps unless such acts are required by a specific procedure and there are no feasible alternatives. We provide

free Hepatitis B vaccines to all of our employees. In addition, we have instituted post-exposure prophylaxis protocols that will be offered to our staff if the need arises. We have a policy and consent form that enables us to determine the Hepatitis-HIV status of the source of the needlestick injury, should one occur. There is an ongoing review of current devices and options in the utilization of hollow bore needles. The simple act of disposing of needles is addressed and has been set as an office priority. We attempt to establish safety awareness in the work environment. Many needlestick injuries can result from unexpected circumstances, such as sudden movement by the physician or staff. Technicians and staff should be trained to be constantly alert to the injury potential when an exposed needle or sharp device is being used (Table 5).

Summary

A simple discussion among colleagues has resulted in hours of research on the Internet and major changes among my staff. We now have a policy in which the transplanting surgeon verbally states, "All sharps have been removed from the field" or "Sharps are still present on the field." We attempt to place all sharps toward the middle of the field in full view. We do not allow the use of gauze centrally that could obscure their view. We have modified our work practices that could pose a threat through needlestick injuries. When I perform surgery, I attempt to place the local anesthesia stand in front of me rather than behind me so that I don't swing around and inadvertently stick a coworker. Finally, there are "training modules" that assist the staff in education and the importance of universal precautions. I am aware of other transplant centers that have developed similar, if not more, progressive programs. They are to be commended.

Is all of this simply an exercise in futility or can we statistically reduce inadvertent exposures? The Bandolier report is convincing. The only way to reduce our individual cumulative lifetime risk is through awareness and the institution of programs such as those mentioned above. It is well beyond the scope of this editorial to lay out such programs, but is not beyond the scope of your practice. ✧

Table 5. Policy Recommendations

1. Eliminate the use of needles where safe and effective alternatives are available.
2. Implement the use of devices with safety features and evaluate their use to determine which are most effective and acceptable.
3. Analyze needlestick and other sharps-related injuries in your workplace to identify hazards and injury trends.
4. Set priorities and strategies for prevention by examining local and national information about risk factors for needlestick injuries and successful intervention efforts.
5. Ensure that healthcare workers are properly trained in the safe use and disposal of needles.
6. Modify work practices that pose a needlestick injury hazard to make them safer.
7. Promote safety awareness in the work environment.
8. Establish procedures for and encourage the reporting and timely follow-up of all needlestick and other sharps-related injuries.
9. Offer free Hepatitis B vaccines to staff.
10. Institute a written exposure plan that offers antiviral prophylaxis.
11. Have consents in place to determine the "source patient's" status.

PHYSICIANS & NURSES REQUIRED

PAI Medical Group is a leading medical hair transplant management company in North America. We are executing our plan for the next phase of expansion and opening of new clinics in the USA.

We are actively seeking talented physicians and nurses with hair transplant experience for our network of clinics and to serve our growing base of highly satisfied repeat and new patients.

To learn more and to become part of our growing resources, please call PAI Medical Group today.

Attn : F. Corsale, Vice-President
 Email: fcorsale@pa-intl.com
 Tel : 613-225-1871 ext. 777
 Fax : 613-225-0717



Vancouver welcomes the opportunity to host the 5th International Congress of Hair Research at the elegant Fairmont Hotel Vancouver. This is the premier meeting of Hair Researchers which will gather over 500 of the leading clinicians, well-seasoned researchers and young investigators from around the world.

This meeting will create a unique opportunity for the discussion and exchange of ideas and offer participants with an insight to the latest developments in this special discipline. Along with clinical topics, such as pattern hair loss, alopecia areata, cicatricial alopecia, other main topics to be discussed will include gene delivery, folliculoneogenesis, hair pigmentation cycling, stem cells, immunobiology, keratins and senescence.

IMPORTANT DATES :

- April 10, 2007** Early registration deadline
- May 14, 2007** Hotel reservation cut off
- June 5, 2007** Regular registration deadline

Visit the Congress website www.hair2007.com for more information, or contact the Congress Secretariat:

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