

**COCA Conference Call**  
**Bombings: Injury Patterns and Care**  
**Richard C. Hunt, MD, FACEP**  
**April 24, 2007**

**Coordinator:** Welcome and thank you for standing by. At this time, all participants are in a listen-only mode. After the presentation, we will conduct a question and answer session. To ask a question at that time, you may press star-1. This conference is being recorded, if you have any objections, you may disconnect at this time. I would like to turn the call over to Mr. Jim Schwendinger. You may begin.

**(Jim Schwendinger):** Thank you, Mary Anne.

I'd like to thank everyone for joining us on today's conference call and we're very, very happy to have Dr. Richard Hunt present about "Blast Injuries and Bombings, Injury Patterns and Care."

So this is a great timely (unfortunately) topic. I hope we won't have to use the information, but it's always good to know in case we do.

Dr. Hunt has been the director of the Division of Injury Response here at the CDC and the National Center for Injury Prevention and Control since 2004. From 1998 to 2004, Dr. Hunt was professor and chair of the Department of Emergency Medicine at the State University in New York (SUNY) and Upstate Medical University at Syracuse.

Before his work in New York, Dr. Hunt served from 1988 to 1998 at the Department of Emergency Medicine at East Carolina University, where he became Vice Chair of the Department and served as the Medical Director of the Helicopter and Ground Critical Care Transport Service.

In January 2004, Dr. Hunt was selected by CDC's Injury Center to head the Division of Injury Response. Since his appointment, he has led the Division in a new direction, setting up processes that resulted in a new division name and realignment with a new vision, mission, and focus priorities.

He is currently guiding research and preparedness activities in disaster and terrorism response as it relates to injuries and fostering partnerships with the acute care injury community that will be crucial in any kind of mass casualty or natural disaster type of event.

So we're very pleased to have Dr. Hunt. He is also going to be assisted by several of his staff on the question and answer part and he will introduce them by name.

I turn it over to you Dr. Hunt. We thank you for presenting this very important and timely information today.

**Richard Hunt:** Thank you for that kind introduction.

Thank you for the opportunity to speak with you. The subject matter experts in our division who are joining me on this call and may be assisting me with some of the questions will be Dr. Paula Burgess, Dr. Ernie Sullivent, and Dr. Scott Sasser. They are all emergency physicians in our division who have been working on this particular topic.

The Institute of Medicine's report on the Future of Emergency Care in the United States brings into focus the issue of terrorist bombings.

Slide please.

Some of the quotes (from the Institute of Medicine report) follow.  
"Explosions are the most common cause of casualties associated with terrorism."

A second quote from that same report is as follows: "More basic weapons, including conventional bombs and improvised explosive devices, appear to be the primary terrorist threats facing the United States today."

Today, we're going to be discussing patient care challenges and systems challenges. We will also mention some resources that are available to you from the CDC.

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This presentation is based on:

1. the scientific literature;
2. input from United States military physicians, who have had experience with explosions in conflicts overseas;
3. the civilian medical folks who've responded to international terrorist bombings.

We haven't had to deal with terrorist bombings in the United States over the past few years. However, we have been fortunate enough to learn from medical personnel in other countries who have had experience with these

attacks. They have engaged with us and helped us learn more about how to prepare and respond to the multiple casualties that result from such attacks. As we have learned from our colleagues in the United States military and those from other countries, we've recognized that bombings in open spaces are very different from those in closed spaces. Most of what you see in the news is describing bombings with improvised explosive devices that occurred in open spaces. An example of "closed space bombing" would be the train bombings. In many of those cases, the doors on those trains have been closed, and the resulting injury patterns differ in many ways. For one thing, the injuries are more severe in closed space bombings than in open space bombings.

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The Division of Injury Response has partnered with nine different organizations. The partnership is entitled the "Terrorism Injuries: Information, Dissemination and Exchange (TIIDE) Project." There is quite a bit of representation from both the public health sector and the injury care provider sector. The partners include the American Medical Association, the National Native American EMS Association, the State and Territorial Injury Prevention Directors Association, the American College of Emergency Physicians, the National Association of EMTs, the National Association of EMS Physicians, the American College of Surgeons, the American Trauma Society, and the National Association of State EMS Directors. Much of the information in this presentation has evolved out of our partnership with these entities.

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More background information: "Explosive Uses Increasing In Terrorist Events." There are indeed unique patient care and system challenges that I'll go into in more depth over the next few slides.

Some recent examples follow:

In the Mumbai bombing in India on July 11, 2006, seven bombs were placed on commuter trains during rush hour. They killed 209 people and injured over 700 others.

In Tel Aviv, Israel, on January 19, 2006, a suicide bomber in a small fast food restaurant killed himself and wounded 20 others. Most of the customers were outside the restaurant, but the bomber went inside and detonated the bomb.

In the London Subway Bombing on July 11, 2005, three bombs exploded on the underground train and one bomb exploded on a bus, killing 56 people (including the 4 terrorists). The bombing injured over 700 people: 350

required hospital treatment, and 22 of them were admitted in serious or critical condition.

In the Madrid Train Bombing on March 11, 2004, 10 bombs exploded in four commuter trains. The bombing killed 177 people instantly and injured more than 2000. Fourteen people died later.

In a Tel Aviv disco on June 1, 2001, a suicide bomber killed 20 people and injured 120 others. The terrorist mingled with a large group of teenagers who were standing in line to enter a disco. While still in line, he detonated the explosives strapped to his body. The explosive charge contained a large number of metal objects, including balls and screws that are designed to increase the extent of injuries.

Lastly, we have learned a lot from our military's experience. We are continuing to work with our military partners to learn what we can that might be helpful to us.

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The Institute of Medicine report on the Future of Emergency Care stated, "Few EMS personnel have any training or experience assessing the scene of a terrorist bombing, or evaluating casualties or a range of potential injuries." While that quote comes directly from the EMS section of that report, I would suggest that this echoes the experience of other injury care providers who may be called on to respond to injuries from a terrorist bombing, including emergency physicians and trauma surgeons.

I spent 15 years as an attending physician in two large major tertiary care (Level 1) trauma centers with volumes of approximately 50,000 patients. During that time, I saw one bombing victim. As I go across the country and talk with my colleagues, that echoes their experiences as well. We must learn from those military medical care providers who have gained experience in the global war on terrorism. This will certainly add to our experience in both open and closed space bombings.

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During terrorist bombings, it turns out that as many as half of the patients seek care in the first hour that follows the incident. One thing we have learned is that severely injured patients arrive after less injured patients. Many resources needed for these severely injured patients may have already been allocated by the time they arrive.

Also, we tend to separate trauma into penetrating trauma and blunt trauma. Patients injured from terrorist bombings may have both (multiple) penetrating trauma and blunt trauma.

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I have mentioned confined or enclosed space bombings that increase the morbidity and mortality from these events. I already alluded to the confined space environment—it increases the morbidity and mortality from these events. Primary blast injury occurs mostly from confined space explosions. I should also mention that many injuries in bombings have occurred from the resultant structural collapse.

Remember the basics: standard triage, trauma resuscitation, treatment, and transfer. When you actually have to respond, gravitate to those standards that you've followed for years. Remember that what you've done before will work for a lot of the trauma you may see after a bombing. In addition, realize that there are nuances that you can access or that we can provide to you rapidly.

And then the other key piece: I've included the following two words in almost every clinical lecture I've given: "Repeat Exams." I offer that in the spirit of not missing anything. But in particular, because we have little or no experience in actually caring for patients with both blunt trauma and multiple penetrating trauma from bombs packed with ball bearings and other projectiles we are not familiar with—the repeat exam is truly important. In retrospect, I should have bolded it on this slide.

When you review these civilian terrorist bombings, up to 75% of patients will actually self-refer by private vehicle. On the other hand, up to 20% of patients may have critical injuries.

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I will provide an overview of blast injuries, but I want to focus on actual patient care and systems issues. The physics of blast injuries are described in depth in a lot of different sources.

Primary blast injury is caused by a blast wave from the over pressure phenomenon. Secondary injuries are caused by flying debris, producing shrapnel like wounds. Tertiary injury is caused by the blast wind, a forced, superheated airflow that can cause a forceful impact ("blast wind" is different from "blast wave"). And then quaternary injury can be caused by other vectors including heat and radiation.

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I want to start with lung injury. This slide shows images of lung injuries resulting from explosions. In one series of patients with pulmonary blast injuries, the butterfly pattern of pulmonary infiltrate was the most common radiologic finding. It consists of bilateral central infiltrates.

You can see in image labeled A, a bilateral central consolidation, that is very much like lung contusion would appear on a chest x-ray. Then a view of the CT scan. Letter C shows the actual chest CT scan, though it is not very easy to see. There is a white arrow indicating pneumothorax; indeed, in pulmonary blast injury, you can have pneumothorax and pneumomediastinum.

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The signs of lung injury are usually present on initial presentation, but in some cases are delayed up to 48 hours.

Lung injuries, after explosions, have been found to be more common when there are also skull fractures, greater than 10% body surface area burns, and penetrating injury to the head or torso. The lung pathology can vary widely, from scattered petechiae to actual confluent hemorrhages.

Lung injuries should be suspected in anyone with any signs or symptoms related to the lung, including dyspnea, cough, hemoptysis, or chest pain. Additional signs and symptoms may include tachypnea, hypoxia, wheezing, decreased breath sounds, and (obviously) cyanosis.

I want to reinforce the butterfly pattern on chest x-ray that was demonstrated previously.

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Treatment for lung injury after a bombing is similar to that of other lung injuries or problems: high flow oxygenation, then fluid management. Really, you can think of lung injury following an explosion in the same context that you do pulmonary contusions. You want to ensure adequate tissue perfusion, but simultaneously avoid volume overload. For those of you who have treated pulmonary contusions before, this requires the same delicate fluid balance.

Endotracheal intubation is mandated for massive hemoptysis, impending airway compromise, or respiratory failure. There are a couple of key points to remember here. One is that positive pressure ventilation could easily result in alveoli rupture or air embolism; secondly, the literature suggests that you need to consider selective bronchial intubation if you have severe hemoptysis or significant air leaks.

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It goes without saying that prompt decompression of a pneumothorax or a hemothorax is important for these patients. If a patient (with blast lung injury) is going to undergo general anesthesia or air transport, you should consider placing a prophylactic chest tube.

Air embolism, which I mentioned briefly, can occur as a result of these injuries. It can present in many, many different forms, with symptoms mimicking that of a stroke, a myocardial infarction, an acute abdomen, blindness, deafness, and spinal cord injury or claudication. Remember to consider air embolism when treating a patient with a blast lung injury. The treatment for suspected air embolism is to put the patient in the left lateral, semi-left lateral or prone position, and provide hyperbaric oxygenation.

There aren't any definitive series of studies to show who can be safely discharged. Even so, it seems reasonable to discharge patients with a normal chest x-ray and normal ABGs after 4-6 hours of observation. While this seems reasonable, I have to remind you that this suggestion isn't based on a whole lot of experience with these patients.

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Moving on to head injuries. This is really worth thinking about. It turns out that most or many of us think about head injury as a blow to the head, or situations where the patient hit a sidewalk or a wall, or was struck. It turns out that the primary blast wave itself can cause a concussion in the absence of a direct blow to the head. For this reason, it is really important that you think about head injury. Traumatic brain injuries are common after explosions. The military and our international colleagues have experienced this, and it is easily overlooked if there is no obvious external injury to the head. Remember that even if the patient did not hit their head or get hit in the head by something, they may still have a traumatic brain injury.

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It is important to consider the proximity of the victim to the blast, particularly when you have a patient that complains of loss of consciousness, headache, fatigue, poor concentration, lethargy, amnesia, or other constitutional symptoms. And also recognize that the symptoms of concussion and post-traumatic stress disorder can be very similar.

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Regarding abdominal injuries, remember that gas filled structures are the most vulnerable. This is especially true for the colon. Abdominal injuries can include bowel perforation and hemorrhage, which can range (as with lung injuries) from small petechial hemorrhages to large hematomas. There can be mesenteric shear injuries, lacerations of solid organs, or testicular rupture.

The symptoms are very much like any other abdominal injury symptoms, including abdominal pain, nausea, vomiting, hematemesis, rectal pain, tenesmus, testicular pain, or unexplained hypovolemia. The clinical signs can be very subtle initially, followed by the patient developing an acute abdomen or advanced sepsis.

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Why would we spend time talking about ear injuries after a bomb blast? It turns out that the tympanic membrane rupture is the most common primary blast injury, and that is important in a lot of different ways.

The signs of ear injury are usually evident on presentation, and are usually recognized on the scene by pre-hospital care providers. However, it is important to realize that isolated tympanic membrane rupture is not necessarily a marker for morbidity. In the Madrid train bombings, tympanic membrane rupture was found in 99 of 243 patients. In one series of 17 critically injured patients, there were 13 patients with ruptured tympanic membranes. Four of the 17 critical patients did not have ruptured tympanic membranes. So again, it's not necessarily a marker for morbidity.

You will find it difficult to communicate with patients who have bilateral tympanic membrane ruptures, which does occur.

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Other injury issues include traumatic amputation, which is a marker for multisystem injuries. Certainly, you should consider delayed primary closure for grossly contaminated wounds. As we've learned from our colleagues, military and civilian, terrorist bombings do frequently result in grossly contaminated wounds. Assess the immunization status.

Remember that compartment syndrome, rhabdomyolysis, and acute renal failure are associated with explosions that result in structural collapse, prolonged extraction, and severe burns.



There is also the possibility of exposure to inhaled toxins—toxins, such as carbon monoxide or cyanide, as well as the formation of methemoglobin. Realize also, there maybe a significant percentage of injured patients with serious eye injuries.

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As I mentioned, there are no definitive guidelines about pregnant patients. I think it is prudent to admit second or third trimester pregnancies. The placental attachment is at risk if the primary blast that causes spalling. The blast wave itself can cause some injuries and placental disruption.

Close follow-up of wounds is important. Potential contamination, plus the possibility of retained foreign bodies, makes followup really important. Also, the possibility of missing subtle head injuries makes followup important. Patients with ear injuries may need long term followup, and remember that any discharge instructions for these patients probably need to be written.

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Mental health issues are another consequence of terrorist bombings. While we're talking about terrorist bombings today, my comments about mental health issues apply just as much to the challenges that our nation faces in response to the shootings at Virginia Tech. So these comments apply to mass casualty events, whatever the actual incident is.

The factors that precipitate mental health problems include the event occurring with little or no warning, the unknown duration, and the possibility of it happening again. It is the combination of the personal threat and the unknown.

For example, five train bombs go off and then there's a bus bomb that goes off. The sequelae include anger, frustration, helplessness, desire for revenge, depressive symptoms, eating problems, and sleep disorders that are prevalent with depression.

You should certainly encourage patients and their family members to talk about the experience, follow their normal routine, avoid alcohol and drugs, and realize that the return to normal will take time.

Consider referral to psychologists, social workers, or other clinicians if the symptoms are persistent, or especially if the patient has difficulty managing these feelings.

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I want to focus for a few minutes on our United States military's experience. They have had significant experience in dealing with blast and explosive injuries. They have, to their credit, been extraordinarily quick to seek and adopt new strategies in treating hemorrhage, the leading cause of preventable death in the kinds of injuries they're seeing abroad. The mortality rates have been dramatically lower for the current conflict than for those in the past.

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Some of the medical advances from the global war on terrorism include the expanded use of damage control surgery, fresh whole blood, tourniquets, hemostatic agents, and hemostatic dressings.

I want to mention the use of damage control surgery to avoid the deadly triad of hypothermia, coagulopathy, and acidosis. Damage control surgery seeks to stop the bleeding, to remove major contaminants, and to leave the wound open (avoiding abdominal compartment syndrome). After the initial damage control surgery is done, the patient is transported or transferred to the intensive care unit where resuscitation continues, including normalization of the blood pressure, temperature, and coagulation factors. Then, about 12-18 hours later, patients return to surgery for their definitive surgical procedures.

Resuscitation for severe hemorrhage in the military experience includes the use of fresh thawed plasma, fresh whole blood, preference for colloid versus crystalloid, and early use of cryoprecipitate and recombinant Factor VIIA.

One of the partnership initiatives this year is to gather the military experiences together in a form that facilitates consideration of what makes sense to translate into the civilian sector. This is a work in progress indeed.

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Next, I want to go over system challenges. Any of you who have been responsible for the care of injured patients knows how important it is to get the patient care piece coupled with the system piece. The two pieces must work together to prevent avoidable morbidity and mortality.

We have learned a lot about coordination during multiple casualty events from our international colleagues, in both the prehospital and hospital settings. Four physicians from our division had the opportunity to spend four days in Spain after the Madrid bombing. We talked with many people, from train security personnel to the nurse-in-charge on the day of the bombing.

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With reference to the prehospital arena, we anticipate that future attacks may include multiple bombs. In London, we saw both the buses and the trains targeted. There may be secondary bombs planted to detonate later, when rescue personnel are present. Interestingly, in one of our conversations, we heard the following statement: “We’re really taking a look at the concept of frequency inhibitors for our ambulances to prevent some of these attacks when we go on the scene.”

The number of casualties can be very large. In discussing triage with one of the leaders of prehospital response in one of these cities, I asked the question, “Well, how did that work out with the triage tag? Did this work out okay?” And you can hear a pin drop. There was a long pause. And he said, “Triage, are you kidding? Triage, in this instance, was alive versus dead.” And I think that speaks to the issue of scalability and what’s manageable with large, large numbers.

We have touched on the dramatic increase in injury severity in vehicles that have closed doors. In addition to the many providers, one of the training security folks we spoke with said, “Oh yeah, all the people that had the really, really bad injuries, or were already dead, were in trains with closed doors.” When even the train security guards realize the difference between “open” and “closed” space bombings—I think we should pay attention.

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One of the challenges has been the lack of communication between the EMS and hospital personnel. In some instances, hospital personnel have learned about a bombing event from family members or from victims who came into the hospital. As many of you know, we don’t have this issue worked out yet.

One of the things we have learned from international civilian experiences is the maldistribution of patients among hospitals. In a large scale event in a city with 15 hospitals, two of the 15 hospitals received approximately 60% of the casualties. It would not be surprising if we were challenged by this as well.

We need to figure out how to truly distribute very large numbers of patients. I’m not talking about 15 patients from a bus crash, but how you distribute a

very large number. That remains a critical issue that I think we need to really work on in our communities and throughout the nation.

An enormous number of medical personnel can be required after a bombing. I think this was another one of those take-home lessons that is pretty unforgettable. The hospital that received the largest number of patients in Madrid is a 1,800-bed hospital. I don't believe we have a 1,800 bed hospital in the United States. It was the largest hospital I've ever seen in my life. Also, fortunately, there was a shift-change when the bombing occurred. There were twice the usual number of medical personnel present to help care for the bombing patients. And then lastly, the damage control surgery issue was important.

It turns out that every point of care really rose to the occasion by figuring out what damage control meant for their areas.

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For the hospitals, they found that critical patients required lots of blood. For example, the closest hospital in Madrid received 312 patients and admitted 91. The blood bank delivered 145 units of type-specific blood during the day (90 units in the first four hours), 60 units of FFP and 75 units of platelets. That's a lot.

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What focused all this for me was a quote from Dr. Fernando Turegano-Fuentes and Dolores Perez-Diaz from the Gregorio Maranon University General Hospital in Madrid, Spain. That quote is as follows: "Mass casualty incidents in urban areas, although rare, are an increasing concern worldwide." Such concerns seemed justified after the recent terrorist bombings in Bombay, India, in July 2006.

The three urban mass casualty incidents that followed the events of 9/11 all have in common that the targets were crowded trains (and the London bus) at the busiest time of the day.

All the incidents imposed an enormous challenge on civilian medical services that were unaccustomed to dealing with events of the kind and the resulting injuries.

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There are a number of resources available, or soon to be available, on our web site. Or, you can contact us through "coca@cdc.gov". We will help you get

this information if it's not easily available to you. On the website there is a course on bombings, injury patterns, and medical care. There is a one-hour module and three-hour seminar. Much of material for this presentation was taken from that course, developed in concert with the American College of Emergency Physicians, joined with CDC and the TIIDE partnership (and other injury care organizations). We also just released a report that I believe is up on our web site entitled "In a Moments Notice: Surge Capacity for Terrorist Bombings, Challenge and Proposed Solutions." This report includes specific recommendations for approximately nine different disciplines ranging from emergency medicine all the way to the blood bank and radiology services.

We also have fact sheets for clinicians and fact sheets for prehospital care providers. This month, an article resulted from one of our international meetings on this topic. It is entitled "Blast-Related Injuries from Terrorism, an International Perspective" by Warner et al. in Prehospital Emergency Care. We can give you that reference if you need it.

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So, what if a bomb goes off and we are called to respond to that?

I have realized, as I'm sure you have, that without practice and experience it is very difficult to respond correctly to anything. And, in particular, it's very difficult to recall this kind of detailed information.

We've approached this by trying to increase awareness through education, as in this activity. Also, we have reacted to actual situations by pushing out information. We have had real life experience in pushing information out about bomb injuries in response to the bombings in London, and also in response to two train bombings in India. We have also drilled pushing this information out in real time in the United States.

In conclusion, I really hope this information provides you with an awareness of the patient and the system challenges in preparing and responding to terrorist bombings. I hope you are also now aware of some of the resources available, based on the experiences of our colleagues who have faced these kinds of events.

It's really clear that while there are some profound challenges in responding to terrorist bombings, it turns out that common sense, heroism, and the human spirit really do prevail.

So hopefully, this has been helpful to you.

Thank you so much for your attention.

**Jim Schwendinger:** Great. Thanks, Dr. Hunt. That was an excellent presentation.

I certainly think that we're going to have some questions with our group. I actually would like to ask one which may be on the minds of some of our listeners.

Could you elaborate a little bit more about that group of folks who may not have certain classical overt symptoms of blast lung injury, but may have gotten enough of a concussive wave to maybe have pulmonary contusions or develop symptoms later? Are there any kind of watch signs like dyspnea, or hemoptysis of course?

And can you elaborate a little more on how long the window is, I guess 24 hours, 48 hours? I've heard kind of variable data on that.

**Richard Hunt:** Well, I think you just spoke to it to some extent. I don't think there is quite enough experience to give you a definitive answer.

However, any lung-related signs or symptoms at all should key you in to the problem. And the other thing is, the proximity of the blast, I think, is something to focus on. That's just basically extrapolating from learning from all these materials.

**Richard Hunt:** Paula?

**Paula Burgess:** Just to point out clinically that in general, with the pulmonary contusion, there will be other physical evidence of external chest trauma such as rib fracture or contusion to the thorax. These things are missing in the traditional blast lung scenario. So that is the one clue in helping differentiate the contusion from primary blast lung injuries.

The probability of having a primary blast injury varies inversely with the distance from the epicenter. So in other words, the further the person is away from where the blast occurred, the less likely they are to have primary blast injury, such as a blast lung injury.

Index of suspicion is going to be really important in making these diagnoses. Also, remember the difference in terms of the pressure that's required to sustain these types of injuries. Typically tympanic membrane rupture can be sustained at pressures as small as five or six pounds per square inch, while blast lung injuries require at least 50 pounds per square inch.

So, just understanding the physics helps you to evaluate the likelihood of a blast lung injury.

**Jim Schwendinger:** Great. Thank you.

**Question:** Yes. On Slide 19, your list of possibility of exposure to inhaled toxins include methemoglobin as an inhaled toxin. Is that what is meant or is that a reaction to an inhaled toxin?

**Richard Hunt:** [see the attached explanation of methemoglobin formation].

**Question:** Dr. Hunt, with regard to the primary pulmonary blast injury, so-called blast lung, you alluded to the Israeli experience where positive pressure, whether through a mask or through an endotracheal tube, was harmful and actually exacerbated the injury.

And what I'm wondering is do you have any knowledge or experience of the use of high-frequency jet ventilators for this purpose? Specifically in the adult population?

**Richard Hunt:** I have not seen any literature with reference to the high-frequency jet ventilators. I know exactly what you're speaking about, but I don't recall hearing about or seeing anything in the literature on it. I think it's a great question though.

If I was to think about that in the emergency department, I'll be doing it de novo for the first time without any sort of background that said this is actually going to work or not work. I really don't know, but might keep that possibility in the back of my mind, as an armamentarium.

**Question:** A couple of comments. I had the opportunity to work with the Israelis getting over there quite a bit and working with them on some of these issues in both directions.

I wanted to comment on the blast lung issue. I think you need to temporize that. I think what they are saying is not the overly vigorous, initially, in using a lot of positive pressure. However, they do use moderate positive pressure in other forms to treat the ARDS that secondarily developed.

And the other comment I would make is to re-emphasize the issue of judicious use of fluid. If there was any message that several of the Israelis gave to me in working with them was we think sometimes that we have to get a lot of fluid to resuscitate the general shock. But what we end up doing is pushing it all into the lungs. So they really go on the low side of maintenance of normal pressure as far as systemic blood pressure unless it's mainly a perfusion.

And the last question, Rick, is would you care to comment on the secondary missile effect of what people are putting into these incendiary devices, and how the Israelis, again, going back, and I think even in London, bolts, nails, pieces of anything you can imagine including old watches that are going into these devices.

Would you comment on the need to be vigilant for those types of injury?

**Richard Hunt:** Yeah. There's a couple of points--let me go back to your comment on the use of fluids.

What you related is also being reinforced in discussions I have had with our international colleagues. A particular one that is memorable is what one terrorist bombing resulted in lot of burn injuries. And so, clinicians would approach it as it was a burn injury and not realize that it was in a closed space, so there might be pulmonary injury as well. And indeed, many of those patients ended up with the fluid overload. So we can create real problems with over aggressive fluid management.

In terms of the different kinds of things that terrorists are putting in these bombs, I guess my only comment is they are extraordinarily creative in trying to find the most damaging type of things to put in these bombs.

We have seen the pictures of nails, bolts, and ball bearings. Did you have anything in mind, Marv, from recent events?

**Question cont.:** The only comment there was that just to remind people that we not only have to now deal with the primary blast, the secondary blast, and the effect of the explosive itself--but also these multi-missiles.

And I think the comment about running out of external fixators and the like, because not only that we see the issues of the soft tissue and the soft and solid organs, but also the bony structures that are being devastated by these missiles - secondary missiles - that are packed into the bomb.

It's sort of like an unbelievable effect of the tinker toys trend to put everything back together and having to think about it--but being very cautious in doing really a whole body scan in these people--because it's been amazing to the Israelis--and I'm sure to others--that where they dealing with what they think of the primary injury, and later when they do the whole body scans, they find these secondary missiles in distal portions of the body.

**Richard Hunt:** Yeah. Thanks.



**Question:** Hello. With the blast injury, we can anticipate extensive victim and provider blood exposure from the spray, and I guess the spillage also. Can you speak to exposure workup and HIV, Type B prophylaxis treatment, and of challenges that would occur with such high-volume needs?

**Richard Hunt:** Yeah. A couple of comments.

Number one, that is an area that we are actively pursuing here. We realize that it is a very important issue that we've had multiple discussions about in ongoing initiatives to try to approach that proactively rather than after the bomb goes off. So "A," I'm glad you brought it up. And "B", "...no, we're not done.

However, we have learned from the experiences that various countries and our military has had in approaching this. There are certainly the considerations of tetanus, the whole hepatitis issue, and even the HIV issue. And I guess, if it had to answer today, I would say you would use your best clinical judgment, based on how you cared for other wounds.

But also realize that in addition, that this differs from the nurse saying, "I've got this person up on floor B with a needle stick." The exposure to these kinds of injuries clearly are not the needle stick exposure. This is far beyond our usual clinical experiences in terms of the contamination. We have wounds with literally body parts contaminating body parts.

So, I think in approaching that, again, there is no formal CDC guidance at this juncture, but we're actively pursuing that, and I'm glad you brought it up.

**Question:** Yes. This morning, there was a big article in USA Today entitled “Chlorine Bombs Post New Terrorist Risk,” and the article pretty much talked about some recent tests of chlorine from water treatment companies in California.

And after I read that, I've got to thinking just the prevalence of chlorine. You can go to pool supply place for 99 cents, get a galloon, you can go to Wal-Mart or any other supermarket, and for under a dollar, get a galloon of basically bleach which is almost the equivalent of chlorine.

And if the potential for that is just kind of all over the place, any comments or thoughts on that?

**Richard Hunt:** I have not read the USA Today article, but I'm aware of the potential for chlorine exposures. The issue of chlorine and other types of hazardous materials that may end up in bombs is certainly a topic for discussion. It's not that we haven't thought about it, but I think one of the things that I've learned over the past couple of years is that what bomb terrorists are doing today will not necessarily be what terrorists are going to be doing tomorrow.

So I'm glad you brought it up and it indeed will be a topic for discussion. They change it, the tactics are changing and it is up to us to really stay on top of what the current trends are. And we'll try our best to do that.

**Question:** Yes, Dr. Hunt, I have a question regarding the limited resources available for burn injuries; in the Madrid explosion obviously, there was a lot of burn injuries. What is your experience with the burn/surge capacity on a hospital with limited resources just in burns alone?

**Richard Hunt:** Right. I am very much aware of the burns being a significant issue. And there has been a considerable attentiveness of HHS and DHS on the burn issue itself. I think that we can probably find the kinds of resources that would be helpful to hospitals that we can refer people on the call to.

I know the American Burn Association has been very engaged with government officials in the development of resources to be able to help with the training issues and how to have folks that aren't so familiar with burn care to become more familiar. There is a lot of activity around that issue. And we'll work on trying to find those resources for you.

**Jim Schwendinger:** Great. Well, Dr. Hunt and colleagues, thank you again so much.

What I'd like the callers, if you didn't get a chance to ask your question, please send it via email at [coca@cdc.gov](mailto:coca@cdc.gov). We will try to shunt it over to Dr. Hunt and his team and get more explicit answers for you.

Also, what we plan to do is send an update reminder just kind of recapping the call and saying the information that Mary Anne is about to provide about the replay number.

We will also include some of the resources that Dr. Hunt went over in his talk.

So without further ado, thank you once more for presenting on this very informative call. And Mary Anne, I'll let you close.

**Coordinator:** Thank you for joining today conference call. If you would like to listen to the replay, you may dial 1-800-297-0781. Again, that replay number is 1-800-297-0781. The replay will be available through May 8, 2007. Thank you.