

Emergency Medicine Reports

Trauma Reports supplement
included with this issue.

Volume 27, Number 24

November 13, 2006

Domestic violence is a serious problem that, unfortunately, is seen all too commonly in our emergency departments. Statistics show, however, that physicians, including emergency physicians, are not good at identifying victims of domestic violence. In part that is because we are too busy to screen all women for domestic violence. We tend to screen those women we believe might be victims—those who are poor or those with lower educational levels. We often overlook those women who are upper class, yet they, too, can be victims of domestic violence. We consider perpetrators to be poor, substance abusers, and those living on the fringe of society. We do not consider physicians, police

Domestic Violence and Intimate Partner Violence

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officers, or governmental officials as possible perpetrators. Domestic violence is a hidden disease.

Many physicians become frustrated dealing with victims of domestic violence. They do not understand why individuals remain in abusive relationships. The ED offers help, and seemingly irrationally, it is rejected. Victims return to the ED repeatedly, adding to the frustration. Understanding the psychology behind domestic violence is important as we deal with the victims. This article covers some of the important aspects of domestic violence in our healthcare system.

Domestic violence is one of the topics for the 2007 LLSA

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To reveal any potential bias in this publication, and in accordance with Accreditation Council for Continuing Medical Education guidelines, we disclose that Dr. Stapczynski (editor) served as a consultant to Pfizer on the drugs linezolid and dalbavancin, Dr. Farel (CME question reviewer) owns stock in Johnson & Johnson, Dr. Hafner (issue editor), Dr. Schneider (editor), Kaplan, Lovelace, Pittard, Lewis, Corcoran, and Dr. Martin (authors) report no relationships with companies related to the field of study covered by this CME activity, Dr. Rivielo (peer reviewer) receives research support from Scios and GlaxoSmithKline.

readings. This article complements the reading required for the LLSA and will be useful when taking the CONCERT exam in the future, where knowledge of domestic violence will be tested.

—Sandra M. Schneider, MD, FACEP, Editor

Case Study

A 40-year-old female presents to the emergency department (ED) around 2 p.m., stating that she fell down some steps and injured herself that morning when she awakened from sleep to go to the bathroom. She says her bedroom is upstairs and the bathroom is downstairs. She further states that she has been ordering sleep medications through an Internet service. Her vital signs are normal, but her speech is slurred and you notice bruises on her face and arms. She admits to smoking heavily at times about two packs of cigarettes per day, and she drinks about a pint of vodka daily. Although there was no evidence of suicidal ideation during the mental status exam, she appears moderately to severely depressed. She expresses concerns many times about her financial situation and says that she does not want to lose her job. She works as an accountant. Her husband started a landscaping business last year, and income from his job coupled with hers “barely makes ends meet” for the

Emergency Medicine Reports™ (ISSN 0746-2506) is published biweekly by AHC Media LLC, 3525 Piedmont Road, N.E., Six Piedmont Center, Suite 400, Atlanta, GA 30305. Telephone: (800) 688-2421 or (404) 262-7436.

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Periodicals postage paid at Atlanta, GA. **POSTMASTER:** Send address changes to **Emergency Medicine Reports**, P.O. Box 740059, Atlanta, GA 30374.

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Multiple copy prices: One to nine additional copies, \$359 each; 10 to 20 additional copies, \$319 each.

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Emergency Medicine Reports has been reviewed and is acceptable for up to 39 Prescribed credits by the American Academy of Family Physicians. AAFP accreditation begins 01/01/06. Term of approval is for one year from this date. Each semester (13 issues) is approved for 19.5 Prescribed credits. Credit may be claimed for 1



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family. As you leave the patient's room, her husband, who is waiting outside, pulls you aside and asks if she is going to be alright. He seems nervous and anxious to tell you about her medication abuse and how he has not been able to stop her from ordering drugs through the Internet. You obtain a psychiatry consult to assess the patient for depression, and drug and alcohol abuse. The patient is admitted to the psychiatry service. Two weeks later, the patient returns to the ED with more bruising, and says that her husband has been physically abusing her regularly. She describes four violent attacks by her husband since her discharge from the hospital two weeks ago. The physical exam this time reveals that both wrists are broken. With the two broken wrists, she is now unable to drive to work, further exacerbating her financial woes and increasing the likelihood of more domestic violence. Patient presentations of this nature are common in emergency medicine.

Definition of Domestic Violence

Domestic violence, or intimate partner violence (IPV), is the exercise of emotional intimidation, non-consensual sexual behavior, economic abuse, or physical injury by a competent adult or adolescent that is utilized to maintain power and control in an intimate relationship with another competent adult or adolescent.^{1,2}

The terms domestic violence and intimate partner violence often are used synonymously. Domestic violence may occur as an act perpetrated by both men and women and it can occur with same-sex or opposite-sex relationships. The perpetrator of domestic violence can be a family member, an intimate partner (married or not), ex-partner, someone of the same race, a different race, opposite gender, and in essence occurs in all cultures. Unfortunately, only about one-third of domestic violence cases in the United States are reported.³

Intimate partner violence takes many forms. The most prevalent, yet hidden form of abuse, is psychological or emotional. Survivors often state that this form of abuse is the hardest to tolerate—even more so than physical assaults. Because the need for power and control is at the root of IPV, abusers generally need to manage every aspect and every minute of their victims' lives, including increasing isolation from family and friends, using intimidation and emotional abuse, coercing and threatening, threatening to harm loved ones or pets, using the children, destroying important and sentimental objects, minimizing and denying the abuse, and shifting blame onto the victim.

Economic abuse involves controlling all the family's financial resources, even if the woman has her own income or comes from a middle- or high-income family. Often battered women are given a weekly or monthly allowance that the abuser deems is sufficient for managing household needs but rarely is. Thus she may not have access to financial resources that would allow her to leave.

Sexual abuse, including repeated rapes and sexual humiliation, often accompanies physical violence but may be the primary form of physical abuse.

The physical battering (which also may include child abuse, injuring or killing pets, and threats with weapons) reinforces the

psychological and sexual abuse.² At some point in the relationship, most victims are so tuned-in to their partners' moods and behavior that all it takes is "the look" or a clenched fist for victims to submit to the abuser's will.⁴

In domestic violence, patterns of behavior may be exhibited by an intimate partner using power to control the other in the relationship. In the United States, 1 out of every 4 women experiences domestic violence during her lifetime as a result of intimate partner abuse. Although men tend to be more likely victims of violence in general, women are more likely victims of intimate partner violence.³ The overwhelming majority of intimate partner violent acts are committed by men. For women between the ages 15 and 44 in the United States, domestic violence is the most frequent causative form of injury.⁵ Victims may be quiet about the abuse because they are embarrassed and fearful of worsening the abuse if their partner is aware of their complaint. There are no typical patterns that define the abuser or the victim. Unfortunately, domestic violence hurts the whole family.

Although domestic violence consciousness has been raised all around the world, there are still pockets where there is not even an expression like "domestic violence" but rather the use of the term "family scandal," suggesting that there are two physically equal partners within the family who argue. This is based on the assumption that women instigate domestic violence: "She provoked violence against herself by making her husband angry."⁵ A survivor of IPV has internalized this message—conveyed by family, friends, society, and the abuser—that she is responsible for her own predicament. To admit that she is being abused is to admit that she is a failure as a wife, a mother, a lover, and a human being. In addition, she is acutely conscious of the seriousness of her situation, even if she cannot admit it to anyone else. She knows what her abuser is capable of doing to her when there are no witnesses other than, perhaps, the children. She knows from personal intuition what mortality assessments show: that one-third of female murder victims are killed by their intimate partners.⁶ Often, these events occur when the victim attempts to leave the relationship.

Statistics

According to the Centers for Disease Control (CDC), most intimate partner violent acts are not reported to the police.⁷ About 20% of IPV involving rape or sexual assault, 25% of physical assaults, and 50% of stalking incidents directed toward women are reported.⁵ Nearly 5.3 million incidents of IPV occur each year among U.S. women ages 18 and older, and 3.2 million occur among men.⁵ Young people represent the most at-risk group: women ages 16-24 experience the highest per capita rates of intimate violence—16 per 1000 women.⁸

Intimate partner violence results in nearly 2 million injuries and 1300 intimate deaths nationwide every year. About 11% of homicide victims are killed by an intimate partner. Approximately 44% of women murdered by intimate partners had visited an emergency department within two years of the homicide.⁹

Firearms are the most commonly used weapons in the

homicide of men and women. Men are most likely to be killed in the street or other public place; women are most likely to be murdered at home by a current or former intimate partner.¹⁰ When guns are present, victims are far more likely to die—12 times more likely than when a firearm is not involved. Half the states in the country have no gun removal laws related to domestic violence, which should be appalling to all policy makers regardless of the socio-political characteristics of any state.¹¹

Victim Presentation

Victim Presents to Emergency Department. For males and females, involvement in abusive relationships is likely to result in depression, stress, and alcohol abuse.⁷ These problems and their associated medical complaints often mask IPV as the cause. Similarly, women with addictions or mental health illnesses often are blamed for their abuse.

Basile, et. al.¹² studied the differential association of intimate partner physical, sexual, psychological, and stalking violence and post-traumatic stress disorder (PTSD) symptoms in a nationally represented sample of women. Their findings revealed that all types of violence are associated with an increase in PTSD symptoms. There was evidence of a dose response in which the more types of violence the patient experienced, the more PTSD symptoms she exhibited.¹²

Intimate partner violence toward the pregnant woman has particular issues. Pregnancy can trigger acts of domestic violence or exacerbate ongoing problems, and increases the risk of homicide.¹³ Homicide is the leading cause of traumatic death among pregnant and postpartum women in the United States, resulting in 31% of maternal injury deaths.¹⁴ Although women appear to be at greater risk of domestic violence during the postpartum period, intimate partner violence directed against pregnant women may be more common than other generalized obstetrical complications. Patterns of violence directed toward the pregnant female include trauma to the abdomen, breasts, and genitalia. Men may be violent toward their pregnant partners because of jealousy and anger toward the unborn child, possibly attempting to cause miscarriage directly; anger against the woman for her inability to cater to his needs; and ongoing business-as-usual type violence.¹⁵ In a study, domestic violence was statistically significantly associated with educational level. Illiterate women reported domestic abuse 2.6 times more than university or more educated women. Among women reporting domestic violence, those with the lowest educational level and income were experiencing all types of domestic violence frequently.¹⁶

Women with children younger than 3 years of age who present to the ED have been found to experience past physical abuse (52%), past sexual abuse (21%), and abuse within the past year (10%). Forty percent of the past abuse perpetrators, 73% of recent abuse perpetrators, and 10% of sexual abuse perpetrators had regular contact with the children of women who presented to the ED with children younger than 3 years old.¹⁷

Physical violence occurs in 11-12% of same-gender couples,

suggesting that domestic violence is an abusive power that can happen in any type of intimate partner relationship. The violence appears to be milder in same-gender couples, and it is unclear what percentage of same-gender violence can be characterized as abuse vs. intimate terrorism. Victims of same-gender violence may also have the added stress of severe isolation and the threat that the abuser may expose the victim's sexual orientation in a hostile manner.¹⁸

Abel describes the design and outcomes of a research project that investigated the similarities and differences between women adjudicated as domestic violence "batterers" and women identified as domestic violence "victims."¹⁹ Findings indicated group similarities in the areas of exposure to violence and social service utilization. Although both groups reported high levels of trauma symptomatology, victim scores were significantly higher. Abel compared a sample of women who were being treated in batterer intervention programs with another sample of women who were receiving domestic violence victim services. Trauma symptomatology includes emotional and behavioral problems such as depression, anxiety, PTSD, battered-woman syndrome, alcohol abuse, and suicidal ideation.¹⁹ Many believe that women who have been adjudicated as batterers are really victims who were fighting back in self-defense. More and more women are being seen as perpetrators of domestic violence. In Abel's study, minority group representation in the victim group was significantly lower than in the batterer sample.¹⁹ Forty-two percent of the women in the batterer group were non-white.¹⁹ In contrast, only 26% of the women in the victim group were non-white.¹⁹

Batterers tend to want to control their partners through exertion of physical dominance and to hold their partners responsible for the violence in their relationships.²⁰ Lorber and O'Leary assessed prediction of husband to wife physical aggression in which the husband had engaged in at least one act of physical aggression toward his partner during their engagement period.²¹ Predictors were measured approximately one month prior to marriage, and physical aggression was assessed again at 6, 18, and 30 months post-marriage. They found that more than 76% of the men who were physically aggressive during the engagement period were physically aggressive at one or more of the next three assessments across the initial 30 months of marriage.¹⁹ Nearly 62% of the participants were severely aggressive at one or more assessments.¹⁹

Victim Presents to Doctors' Offices. Only one in four victims of domestic violence who come to EDs actually report domestic violence abuse, and one in three victims of domestic violence report abuse to their primary care provider.³ The American College of Emergency Physicians has had a long-standing policy advocating for screening for domestic violence in the ED. It also calls for training of all ED staff in domestic violence. Yet, nearly 25% of patients presented to family practice clinics had incidents of intimate partner violence in the past year, with about 40% lifetime prevalence.⁵

The American College of Obstetricians and Gynecologists and the American Medical Women's Association recommend that

physicians screen all patients for intimate partner violence. For women who are not pregnant, this should occur at routine ob/gyn visits, family planning, or preconception visits.^{22,23} Women who are pregnant should be screened regularly over the course of the pregnancy, including post-partum, since some women do not disclose abuse the first time they are asked. Abuse can also occur later in pregnancy.²² Family practice physicians can emulate this practice as well by routinely screening for IPV at annual physical exams or other periodic visits.

Victim Presents to Police Department. Victims often have a history of calling for help from law enforcement. Many states have laws mandating arrest if the responding officers determine that an assault occurred. However, enforcement of these laws varies and may result in the arrest of both perpetrator and victim if the officer is not trained to evaluate the difference between an offensive and defensive injury, or the officer has not been adequately trained on domestic violence issues in general. Stuart et. al.²⁴ studied reasons for intimate partner violence perpetration among arrested women. They administered to 87 women in violence intervention programs a questionnaire assessing 29 reasons for violence perpetration. They found self-defense, poor emotion regulation, provocation by the partner, and retaliation for past abuse as the most common reasons for violence perpetration.²² Women victims of severe partner violence were significantly more likely than victims of minor partner violence to report self-defense as a reason for their violence perpetration.²²

Racist and discriminatory practices within community services, such as police departments, government organizations, and shelter facilities may be discouraging to both immigrants and racially visible abused women in reporting the violence and seeking help. Immigrant and racially visible women must contend with the dominant cultural paradigm in neglecting and sometimes even denouncing their lived reality and belief systems.²⁵

When the police are contacted, whether by a telephone call or in person, the abuse becomes public. Just as the privatization of domestic violence contributes to its continuation, perhaps public knowledge can prevent occurrence.²⁶ In their study, Gracia and Herrero, using a national probabilistic of a Spanish adult population, tested a hypothesis regarding correlates of public attitudes toward reporting partner violence against women.²⁷ Results indicated that low tolerance of partner violence against women was significantly associated with a positive attitude toward reporting partner violence against women. Interestingly, the odds of having a positive attitude toward reporting were almost two times as high for people not personally exposed to partner violence against women as they were with people personally exposed.²⁶

Domestic violence thrives on a social climate of secrecy, tolerance, passivity, and victim inhibition.^{27,28} Gracia and Herrero state that unreported cases of domestic violence against women are the result of social silence, tolerance, and inhibition. In their study, Anderst, Hill, and Siegel documented that women are less likely to disclose domestic violence if they are informed of state-mandated reporting laws before the domestic violence

screen takes place and even less likely to report domestic violence if the screening utilizes a written self-administered survey.²⁹ Victim retraction is almost universally viewed by criminal justice officials as a problematic outcome in cases of domestic violence.²⁸ The nature of institutional responses to victims can leave them feeling isolated and vulnerable. Often, victims' frustration associated with the criminal justice system, coupled with pressure from the abuser, leads them to recant or drop charges. In a study of those victims who retracted, almost half retracted before trial (44%) and more than one-third (35%) retracted before the defendant entered a plea.³⁰ Seven percent retracted on the day of the trial. The most common way the victims retracted was through the police.²⁶ Thus, multi-agency coordination in domestic violence cases is essential to preventing victim retractions.

Women who experience domestic violence often report prior exposure to other episodes of interpersonal violence. In their study of female residents in a domestic shelter in New York City, Griffing, et. al., in their exploration of the prevalence of prior abuse found that more than one-half of the sample reported past violence exposure, which included either personal victimization, maternal domestic violence, or both.³¹ The most frequently reported form of personal abuse was childhood sexual assault.

Victim Presents to Other Community Settings. Victims of abuse, especially women, often suffer substantial physical injuries as well as elevated rates of depression and other mental health problems, substance abuse, and suicide. They may feel entrapped and unable to access support services available in their communities for these problems, and in turn, these agencies may not screen for domestic violence, or if they are aware of the abuse, may not be trained to respond appropriately—or the agencies may have their own agendas that conflict with strategies for empowering victims to get free of the abuse.

Ellison and Anderson studied the religious involvement and domestic violence among U.S. couples.³² They found that regular religious attendance is inversely associated with the perpetration of domestic violence.³² Among men who attend religious services weekly and women who attend at least monthly, there tends to be a protective effect of the religious involvement against domestic violence. Often women receive significant social and spiritual support from their religious organizations. This is particularly true for immigrant women and African American women. Yet, if they receive negative responses, such as from trusted clergy who offer harsh admonitions to be submissive wives regardless of the behavior of their husbands, victims' isolation and alienation from existing community resources multiplies. Their feelings of shame and self-blame reinforce their silence.

Frequently, victims of IPV seek help via domestic violence hotlines run by domestic violence programs. The anonymity of these hotlines often provides a feeling of safety for women who are terrified that their abusers will find out they are seeking assistance from the outside world. But because shelter locations are rarely made public, each program must arrange

with either law enforcement or an emergency department, for example, to be a staging location where victims may safely come and then be transported to the venue of the emergency shelter. Shelters aren't always safe for lesbian victims, however. While many are open and welcoming to victims of same-sex IPV, others have not trained their staff to be sensitive to this issue, or to be aware that the abuser might show up at the shelter also claiming to be a victim.

Victim Discusses Domestic Violence with Family Member or Friend. Women tend to use more avoidance strategies when they are remaining in abusive relationships and they try to cope with ongoing violence. Women who receive positive responses from help sources such as friends, family, police, and the courts have greater confidence in their abilities to change their situation and are more likely to access the support services as opposed to remaining in the relationship that results in continued battering.³³ Sagrestano, et. al. studied the associations between demographic, psychological, and relationship factors in domestic violence during pregnancy.³⁴ Their results indicated that controlling for demographics, more frequent violence was associated with less support and satisfaction with support from the baby's father, more negative interaction with the baby's father, and more verbal aggression in their relationships than those who did not report violence.

Challenges Faced by Healthcare Providers

Unfortunately, some women will never talk to anyone about being abused because of the significantly high rate of homicide associated with intimate partner violence. Ramsden and Bonner suggest that EDs are key players in the health system for identifying and intervening early for domestic violence.³⁵ In describing their experience with screening for domestic violence in an ED in Sydney, Australia, they caution that the screening process can be a challenge. In their study, ED staff members identified lack of time to ask questions, lack of privacy and confidentiality for patients, and no after-hours social worker for referrals as significant problems. Inappropriate questions are not infrequently asked of patients during the history taking, based on the type of presentation.³⁵

The general lack of domestic violence education of doctors and nurses in health systems is the first challenge to effectively addressing IPV in this setting. In EDs there generally is a lack of time (the "Pandora's box" problem: open it and a host of other issues will pour out). A feeling of powerlessness on the part of healthcare providers regarding issues of intimate partner violence may be due in part to the vague fear that in the end there is little that can be done. Screening is not performed for fear of offending the patient, or staff is concerned about invading a patient's privacy.²² In addition, staff may become frustrated when a victim repeatedly rejects help. In addition, the absence of adequate alternatives for battered individuals may be problematic in some areas.

These concerns can be assuaged by adequate training and strong leadership on the part of the managing medical staff. Listening to the staff members' concerns and responding to these

Table 1. IPV Screening Questions

1. Within the past year—or since you have been pregnant—have you been hit, slapped, kicked, or otherwise physically hurt by someone?
2. Are you in a relationship with a person who threatens or physically hurts you?
3. Has anyone forced you to have sexual activities that made you feel uncomfortable?

Additional questions may further assist in IPV screening, for example:

1. Have you ever felt unsafe or been fearful of anyone (such as your partner/husband/child/relative)?
2. Is anyone trying to control you (such as monitoring how far you drive in the car by tracking the mileage, how much money you spend, what you wear)?⁴³

issues will go a long way toward gaining their commitment to this problem.

Additional Challenges and Considerations

Women of color experience an element of distrust, lack support systems and find it more difficult to discuss IPV with their medical professionals who appear to be irritated with IPV issues.³⁶ And yet, rates of IPV are no different than rates among white women.

Violence in families and in intimate relationships is widespread in Latin America and the Caribbean. Arscott-Mills studied intimate partner violence in Jamaica.³⁷ Results revealed a high level of physical injury (89%) and a low level of reporting violent incidents to the police (26%). Although 75% of these women sought medical care, they also report first turning to look for assistance from their pastors and counselors.³⁷

In comparing lesbian and heterosexual women regarding physical and sexual violence, Bernhard found that significantly more lesbians (51%) than heterosexual women (33%) had experienced non-sexual physical violence and there was no difference between groups in the prevalence of sexual violence (lesbians 54%, heterosexual 44%).³⁸ Because lesbians are also at greater risk of hate violence than heterosexual women, lesbians may experience more violence than heterosexual women, experience cultural barriers, language barriers, physical and social isolation, and lack links to community support systems. Traditional resources may not be lesbian- or gay-friendly, and may be unprepared for assisting transgender victims. The organization Communities United Against Violence states that from 2002-2003, domestic violence reports from gay men and lesbians increased 21%, and reports from transgender people increased as well.³⁹

Immigrant women experience cultural and language barriers, physical and social isolation, and lack links to community support systems. An undocumented woman also faces the possibility of arrest and deportation if she reports her abuse, even if her spouse is a legal resident, because he controls her application for a work permit and can withdraw it at any time.⁴⁰

IPV often is overlooked in the elderly because healthcare workers are concerned for the particular presenting medical conditions that affect the elderly and do not seriously consider IPV.

Older women often are not identified as victims of intimate partner violence in the medical setting because providers think of IPV as a problem of younger women. Providers are encouraged to identify signals of potential abuse, to create privacy for all patients, and to be on the alert for signals of abuse among older women.

People with disabilities are oft-overlooked victims of domestic violence. While all people with disabilities are at risk for abuse, women with mental and physical disabilities are particularly at risk. In Virginia, 46% of domestic violence program advocates reported that many of their clients had mental health disabilities. In the same study, 7% of disability service providers said that most of their women clients had experienced IPV, while 29% said many clients, and 25% of them said that some of their female clients were victims of domestic violence.⁴¹ Many providers search for domestic violence in people of lower socioeconomic class. Domestic violence, however, can occur in all social classes and among professionals, including physicians.⁴² Both victims and perpetrators can also be found among the powerful and wealthy of our society.

How to Screen

Healthcare workers must remember to ask about IPV, document findings, assess the safety, and refer patients for care as needed. A number of screening tools are available on the web that are designed for use by healthcare professionals.

Screening for domestic violence need not be complicated. Considering that victims rarely are asked simple, gentle, yet direct questions about these issues, and the very act of asking may provide relief and comfort, the simplest approach is best. The American College of Obstetricians and Gynecologists²² suggests that the healthcare provider state the following:

“Because violence is so common in many women’s lives and because there is help available for women being abused, I always ask these questions...”

The ACOG screening tool is designed so that a “yes” response to any question prompts a referral. As indicated by the concerns of particular populations described above, this tool is most effective when used with all ED patients—women and men alike.

Common Presenting Complaints

Patients with a history of domestic violence typically provide numerous clues to their situation. However, they do not reveal these clues easily, particularly if the department environment is unsafe for them. An understanding of the dynamics of abuse on the part of the entire medical staff is key to establishing safety.

Kerr, Levine, and Woolard¹ state that historical clues to IPV include: a delay in requesting care, a history inconsistent with injury, vague or nonspecific complaints, multiple physician visits, ED visits at odd times for chronic complaints, and injuries during pregnancy. Behavioral clues to domestic violence

Table 2. Common Presenting Complaints

- Migraine and other frequent headaches
- Gastrointestinal disorders
- Premenstrual syndrome
- Back pain
- Disability preventing work
- Confusion, anxiety, withdrawal, guilt, nervousness, distrust of others
- Post-traumatic stress disorder, including emotional attachment, sleep disturbances, flashbacks, mental replay of assaults
- Depression, attempted or completed suicide, alienation
- Unhealthy diet-related behavior such as fasting, vomiting, abusing diet pills, overeating
- Strained relationships with family, friends, and intimate partners

include: an overly protective or controlling partner, an evasive patient who is reluctant to speak in front of partner, and who is inappropriately unconcerned with obvious problems. Physical clues to domestic violence include multiple injuries, injuries of different ages, central distribution of injuries, and injuries suggesting a defensive posture (i.e., forearm bruises or fractures).¹ (See Table 2.)

Intervention and Referral

An established protocol and treatment plan is essential for all staff to feel confident in their ability to respond appropriately to the need of a victim of IPV, and makes it clear that domestic violence is considered a high priority. The process of developing a safety plan should involve local agencies as part of a coordinating council or domestic violence response team. This will ensure that the victim receives appropriate support following her ED visit, whether from the local domestic violence program (including but not limited to an emergency shelter), child protection agencies, TANF (Temporary Assistance for Needy Families), and that any evidence collected for a possible criminal case is preserved properly for admissibility in court. These local agencies also can provide wisdom and support to the ED staff, who may be quite anxious about these cases, or even question the appropriateness of directly addressing these issues with patients for fear of offending them.

1. Establishing patient safety is critical to any further attempts at assistance. Immediately upon suspecting that abuse is a possibility, ensure that the abuser is not in the examination room and is sufficiently distracted so that the victim will not fear his return.

2. Screen the patient for IPV using a verified screening tool such as the one above, with which staff have been trained.

3. If the patient confirms that she is being abused, or if she denies it despite present indicators, contact the social worker for immediate intervention. A danger assessment must be done in order to proceed.^{43,44}

4. Use body diagrams to document injuries to establish a history of injuries for criminal prosecution. Evaluate and treat patient for life-threatening injuries as well as possible fractures. If the patient discusses coercive sex as part of the abuse (which

would include “making love” after a violent episode), consider rape kit collection as well.

5. Consideration of patient safety must include that of her children who may be at home with the abuser.

6. If an immediate threat is present, security must be notified and the patient must be moved to a room with a door, if this isn't the case already.

7. If an immediate threat is not present, the physician then obtains a more complete patient history, diagnoses the current medical or surgical issues, and thoroughly documents the abuse (through photographs as well as written notes).

8. The social worker will discuss the patient's options, such as a safety plan, emergency housing, legal advocacy, hotlines, and emotional support and counseling referrals. If police have been notified (only with the patient's permission), they will need to interview the patient as well. Ideally, these two discussions can occur simultaneously so that the patient does not have to repeat her story.

9. If shelter space is unavailable and the patient is at risk, consideration for hospital admission should be made until further social service intervention is possible.

10. The patient is discharged, either to return home or preferably to a safer environment, such as a domestic violence shelter.

a. If the patient does not accept a referral to a shelter, she should be provided written material and should understand that she is returning to the unsafe environment of her home (even if her partner is arrested, he will be released within hours, more than likely). She should understand that she will have to hide any evidence that others know of the abuse. Written materials must be in a format that can be hidden. For example, she could keep information in a tampon box (even if she is post-menopausal, she might have an old box in a cabinet), or give it to a trusted neighbor or friend.

b. If she does accept a referral to shelter, then the social worker will arrange for her transport to the facility.

11. The social worker should follow up with the patient after discharge.

Treatment

Whatever constructs might be applied in understanding domestic violence, mental health professionals, counselors and therapists do well to apply contextual analysis in examining both individuals and environmental factors.⁴⁵ Taft, et. al.,⁴⁶ studied race and demographic factors in treatment attendance for domestically abusive men. Treatment dropout is an area of great concern in counseling programs for domestically abusive men.⁴⁶ The authors enrolled 101 male participants (40 African American and 61 Caucasians) in the study. These men electively sought treatment for domestically abusive behavior. The study showed that self-referred African American males were at the greatest risk for dropout.⁴⁶ Clinical treatment programs have shown that there are lower rates of violence recidivism in males who complete the program vs. those who drop out.⁴⁶

Feminist therapy can be a counseling means of helping abused women. However, many feminist theories of therapy

make the assumption that societal power imbalances are based primarily on gender and equality and, consequently, fail to consider the other forms of oppression abused women experience.²⁵ In this context feminist therapy may not be effective for women not of the dominant culture. Acknowledging this disparity, domestic violence programs have increasingly integrated issues relevant to women from non-dominant cultures, sexual minorities, and women with disabilities into their counseling programs. This commitment to ensuring that programs are open to all victims of abuse varies from state to state and program to program. However, there is much to learn from the process by which the anti-violence movement includes survivors of IPV, consumers of mental health care, women of color, people with disabilities, non-English speakers, LGBT people, and others in the effort to strengthen outreach.

As stated above, any attempt to treat battered women is only as effective as the system that is established to assist them. If the family remains intact, a network of support still is necessary to support the victim and monitor the behavior of the batterer. The most successful programs appear to be those that involve all the stakeholders: medical care providers, criminal justice agencies, domestic violence programs, social services, churches, attorneys, and others.

Conclusion

Recognizing IPV can be challenging to healthcare providers. Despite this challenge, key professional healthcare associations support and offer screening processes and protocols for addressing IPV in EDs and other medical settings.^{22,47-49} Several admirable models exist for others to emulate. Domestic violence screening and intervention must be a priority of healthcare providers at all levels, especially by those who are on the front-line and who see first-hand the damage IPV causes. Appropriate intervention and referral may prevent serious injury, trauma, and death to victims and their children, and may break the cycle of violence.

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Physician CME Questions

101. A characteristic of IPV perpetrators can include which of the following?
 - A. Insisting on remaining close by or in the examination room while the injured partner is being interviewed
 - B. Substance abuse
 - C. Concern for victim
 - D. History of assault and battery against other people in public places

102. Indications that a patient might be in an abusive relationship include

which of the following?

- A. A patient who is evasive and reluctant to speak in front of her partner
- B. A history of frequent physician visits, often with vague complaints
- C. Detailed explanations about how injuries were received
- D. Both A and B

103. Which of the following is a barrier to adequate screening of patients on the part of healthcare professionals?

- A. Lack of concern about the complexity and ambiguity of cases
- B. Belief that domestic violence is not a serious problem
- C. Too much PTSD among staff
- D. Fear of offending the patient

104. Domestic violence may include which of the following behaviors?

- A. The exercise of emotional intimidation
- B. Non-consensual sexual behavior
- C. Physical battering by a competent adult or adolescent
- D. Controlling the family's financial resources
- E. All of the above

105. Which of the following groups is most at risk for IPV?

- A. Women between the ages of 36-45
- B. Women between the ages of 16-24
- C. Women between the ages of 25-35
- D. Women between the ages of 45-55

106. Common presenting complaints of IPV victims may include:

- A. depression.
- B. headaches.
- C. dysmenorrhea.
- D. back pain.
- E. A, B, and D.

107. Appropriate screening questions to ask victims about IPV include:

- A. Has anyone forced you to have sexual activities that made you feel uncomfortable?

Emergency Medicine Reports

CME Objectives

To help physicians:

- quickly recognize or increase index of suspicion for specific conditions;
- understand the epidemiology, etiology, pathophysiology, and clinical features of the entity discussed;
- apply state-of-the-art diagnostic and therapeutic techniques (including the implications of pharmaceutical therapy discussed) to patients with the particular medical problems discussed;
- understand the differential diagnosis of the entity discussed;
- understand both likely and rare complications that may occur.

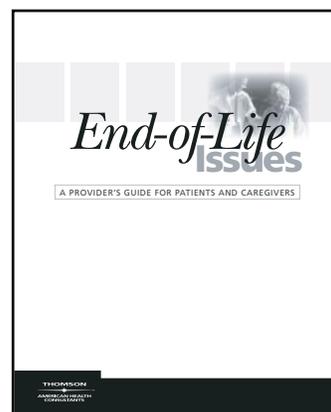
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- B. Do you use illicit substances?
- C. Is anyone trying to control you?
- D. Are you in an intimate relationship where you feel unsafe or fearful of your partner?
- E. A, C, and D

108. Intimate partner violence does *not* occur in same-sex relationships.

- A. True
- B. False

109. In one study, ED staff identified which of the following as challenges faced by healthcare providers in dealing with domestic violence?

- A. Lack of privacy for patients
- B. Lack of time to ask questions
- C. Lack of after-hours social workers
- D. All of the above

110. Pregnancy increases the risk of homicide in domestic violence.

- A. True
- B. False

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CME Answer Key

101. A	106. E
102. D	107. E
103. D	108. B
104. E	109. D
105. B	110. A

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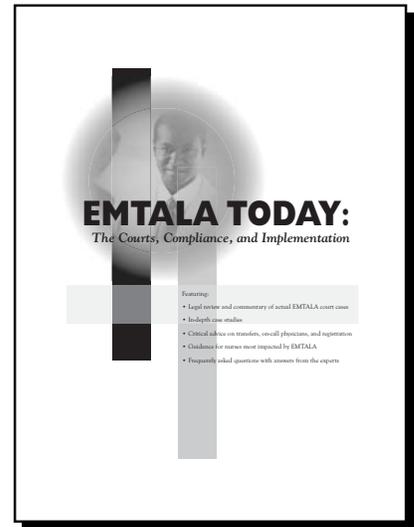
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IPV Screening Questions

1. Within the past year—or since you have been pregnant—have you been hit, slapped, kicked, or otherwise physically hurt by someone?
2. Are you in a relationship with a person who threatens or physically hurts you?
3. Has anyone forced you to have sexual activities that made you feel uncomfortable?

Additional questions may further assist in IPV screening, for example:

1. Have you ever felt unsafe or been fearful of anyone (such as your partner/husband/child/relative)?
2. Is anyone trying to control you (such as monitoring how far you drive in the car by tracking the mileage, how much money you spend, what you wear)?

Common Presenting Complaints

- Migraine and other frequent headaches
- Gastrointestinal disorders
- Premenstrual syndrome
- Back pain
- Disability preventing work
- Confusion, anxiety, withdrawal, guilt, nervousness, distrust of others
- Post-traumatic stress disorder, including emotional attachment, sleep disturbances, flashbacks, mental replay of assaults
- Depression, attempted or completed suicide, alienation
- Unhealthy diet-related behavior such as fasting, vomiting, abusing diet pills, overeating
- Strained relationships with family, friends, and intimate partners

Supplement to *Emergency Medicine Reports*, November 13, 2006: "Domestic Violence and Intimate Partner Violence." **Authors:** **Claire N. Kaplan, PhD**, Director, Sexual and Domestic Violence Services, University of Virginia Women's Center, Charlottesville; **Daisy Lovelace, MEd**, University of Virginia, Charlottesville; **Leslie-Anne Pittard, MEd**, University of Virginia, Charlottesville; **Dion Lewis, MEd**, University of Virginia, Charlottesville; **Caitlin Corcoran**, University of Virginia, Charlottesville; and **Marcus L. Martin, MD**, Professor and Chair, Department of Emergency Medicine, Assistant Dean, School of Medicine, Assistant Vice President, Office of Diversity and Equity, University of Virginia, Charlottesville.

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Trauma Reports

Vol. 7, No. 6

Supplement to *Emergency Medicine Reports and Pediatric Emergency Medicine Reports*

Nov./Dec. 2006

Penetrating neck trauma continues to be a challenging subset of trauma care. This area is loaded with potential high-risk injuries and controversies about the optimal management. The literature favors a more selective approach to these patients, however, the fundamental principles of resuscitation still apply because airway compromise and exsanguination are the greatest immediate life threats. This article reviews the medical literature on the diagnosis and management of these complex injuries.

— The Editor

Introduction

The management of penetrating neck trauma presents a significant challenge to emergency personnel. Penetrating injuries to the neck present a challenging diagnostic and therapeutic dilemma because the spectrum of injuries ranges from minor to acutely life threatening. Successful management requires a practical understanding of the

anatomy of the neck and the tremendous number of vital structures in close proximity. A thorough diagnostic and management strategy must be implemented in the emergency department (ED) to avoid missing potentially devastating injuries. Optimal strategy remains controversial, and

there remains substantial institutional variation.

Epidemiology

Although there has been a decrease of penetrating neck injury in the United States in the past years, it remains a significant public health concern.¹ This is due to the epidemic numbers of firearm-related injuries from interpersonal violence that still occur, particularly in highly populated urban areas. Most injuries are secondary to stabbings or gunshot wounds. Penetrating neck trauma accounts for 5%-10% of all traumatic injuries in some urban trauma centers.²⁻⁴ Most penetrating injuries to the neck involve zone II, which extends

Penetrating Neck Trauma

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Dr. Dietrich (editor in chief) reports that she receives grant/research support from the National Institutes of Health and is the medical director for the Ohio Chapter of the American College of Emergency Physicians. Drs. Hanlon and Sumrok (authors), and Stafford (peer reviewer), Ms. Finerty (nurse reviewer) report no relationships with companies related to this field of study.

from the cricoid cartilage to the angle of the mandible. As with most penetrating trauma mechanisms, males are affected more commonly than females by approximately fourfold.² Mortality from penetrating neck trauma ranges from 2% to 10%.^{2,3}

In the neck, vascular structures are the important anatomical structure most often injured.² Venous injuries occur more often than arterial injuries. The common carotid artery is the most common arterial injury, with the subclavian artery being the next most commonly injured.² Laryngotracheal and esophageal injuries occur almost equally with esophageal injuries being less common.^{2,5}

Historical Perspective

Historical accounts of penetrating neck injury date to antiquity. One of the first works involves an esophageal injury from a stab wound 5000 years ago.⁶ Ambrose Pare described the first repair of a cervical vascular injury.⁷ Both the common carotid artery and internal jugular vein were lacerated and subsequently ligated. The battlefield gave rise to many accounts and advances in diagnosis and management of penetrating neck trauma. During the Civil War, penetrating neck trauma management focused primarily on observation. Mortality rates were approximately 15%.⁸ World War I management also focused primarily on observation, although exploration and ligation became more prevalent. Mortality rates remained essentially unchanged. By World War II through the Vietnam conflict, mandatory

exploration with vascular repair was the accepted practice.⁹ Although this strategy missed very few injuries, it resulted in numerous negative surgical explorations. Today's modern diagnostic capabilities have given rise to new management strategies, some of which focus on nonoperative management following diagnostic testing or observation alone.

Etiology

The etiology of penetrating neck injuries can be divided into three categories: gunshots, stabbings, and miscellaneous. Each category has different predisposing factors and injury patterns. Gunshot wounds and other high-velocity injuries generally produce greater damage and thus are more likely to require surgical exploration. Injuries from gunshots and stabbings most often have a clear etiology, and their epidemiological patterns vary according to causal factors (e.g., crime rates, hunting accidents, military activity). Concomitant injury patterns obviously must be diagnosed and managed. The miscellaneous category represents a broad spectrum of injury by various other penetrating objects — from automobile glass secondary to car collisions to impalement from airborne objects. Associated injury patterns can be as broad and unpredictable as the mechanism of injury itself.

The pediatric patient with penetrating neck trauma represents a unique management challenge. This type of injury is uncommon in the pediatric population, but the potential injuries and complications can be devastating.¹⁰ Literature on diagnosis and management regarding the pediatric patient is also scant. One study demonstrated motor vehicle collisions to be the most common mechanism of injury at 32.2%. Gunshot wounds and animal bites followed at 22.8% and 12.9%, respectively.¹⁰ A specific mechanism of concern is penetrating neck injuries from air-guns because physicians and other personnel may mistakenly consider BB gun injuries as somewhat trivial. Significant injuries have been reported, including an expanding spinal hematoma.¹¹ Mortality rates were similar to the adult population. Zone II injuries were most common, a fact also seen in the adult studies.¹⁰ Associated injury patterns remain very broad, depending upon the mechanism of trauma and whether the injury is isolated or associated with multiple injuries.

Pathophysiology

The pathophysiology of penetrating injury is relatively straightforward. Traditionally, gunshot wounds are divided into low-velocity weapons (< 1000 ft/sec) and high-velocity weapons (>2500 ft/sec).^{12,13} Low-velocity weapons, which includes most handguns, tend to cause direct vascular injury. High-velocity weapons (e.g., hunting rifles and assault rifles) cause cavitation or disruption of tissue well removed from the tract. Types of *direct* vascular injury include intimal flap (most common), (*Figure 1*) transec-

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Figure 1. Gunshot Wound to Zone II of the Neck

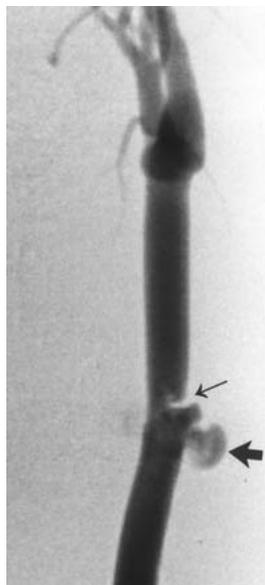


Figure 1. A 59-year-old man who attempted suicide by gunshot to zone II left neck. Lateral view from common carotid arteriogram confirms the pseudoaneurysm (thick arrow) and intimal flap (thin arrow).

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Figure 2. Arteriogram of Patient with a Stab Wound to the Neck



Figure 2. A 21-year-old man who presented with stab wound to right neck traversing zones I and II. Anteroposterior view from arteriogram shows pseudoaneurysm (arrow) of proximal right common carotid artery.

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tion, laceration, puncture, arteriovenous fistula, and pseudoaneurysm (Figure 2).¹² Types of indirect vascular trauma include spasm, external compression, mural contusion, and thrombosis.¹² Although the ballistics may be relatively straight forward, the path of the bullet may be difficult to predict.

The injuries from stab wounds are directly related to the characteristics of the weapon used, although the path and depth of penetration are often difficult to predict. Apparently minor wounds may be associated with significant underlying injuries.

Anatomy

The anatomy of the neck is complex. There are many important structures in proximity to each other. Traditionally, the neck is divided into three zones for the management of penetrating trauma. (See Table 1 and Figure 3.) Zone I extends from the sternal notch to the cricoid cartilage. Injuries to zone I have the highest mortality due to associated injuries to intrathoracic structures (Figure 4).² Zone II lies between the cricoid cartilage and the angle of the mandible. Zone II injuries are the most common. Zone III consists of the upper neck above the angle of the mandible to the base of the skull. Surgical exposure is difficult in zones I and III.

Another classification separates the neck into triangles. The sternocleidomastoid muscle is the anatomical landmark that divides the neck into anterior and posterior triangles.¹³ The *anterior triangle* lies between the anterior midline of the neck, the inferior aspect of the angle, and the anterior border of the sternocleidomastoid. The *posterior triangle* is bordered by the posterior aspect of the sternocleidomastoid, the middle third of the clavicle, and the anterior aspect of the trapezius. Injuries to the posterior tri-

angle have a lower incidence of significant injuries than those to the anterior triangle.¹⁴

The fascial and muscle planes of the neck are extremely important in the evaluation of penetrating injuries. The platysma is a thin, broad muscle that originates from the deep fascia that covers the upper chest and inserts on the inferior aspect of the mandible.¹³ It is covered anteriorly by the superficial fascia and by the deep fascia posteriorly. Any violation of this muscle defines penetrating neck trauma and mandates surgical consultation. The deep fascial layers may help contain a hematoma. These fascial layers also may provide a route for spread of infection in case of injury, especially the pretracheal fascia, which connects to the anterior pericardium.^{2,4}

Clinical Features of Penetrating Neck Trauma

Isolated penetrating neck injuries are uncommon. Penetrating neck injuries occur most often in the setting of multiple trauma.⁴ The presentation may range from relatively asymptomatic to dramatic and acutely life-threatening depending upon the structures involved. To avoid missing subtle findings, the search for injuries must be systematic. The history and physical examination should be directed to the areas of potential injury including vascular, laryngotracheal, esophageal, and neurological injuries.¹⁵

Vascular injuries occur in approximately 25% of patients with penetrating neck injuries.¹⁵⁻¹⁷ Exsanguination is the most common cause of immediate death after a vascular injury.¹⁷ Morbidity and mortality also result from

Table 1. Anatomic Contents of the Zones of the Neck

ZONE	LOCATION	ANATOMICAL CONTENTS
I	Sternal notch to cricoid cartilage	Proximal subclavian vessels, proximal carotid artery, vertebral artery, internal jugular vein, trachea, esophagus, thyroid, thoracic duct, cervical nerve roots, spinal cord, and apex of lung
II	Cricoid cartilage to the angle of the mandible	Common carotid artery, external & internal carotid artery, vertebral artery, jugular veins, larynx, trachea, esophagus, phrenic nerve, vagus nerve, spinal cord, and recurrent laryngeal nerve
III	The angle of the mandible to the base of the skull	Distal internal carotid artery, vertebral artery, jugular veins, oropharynx, salivary glands, and cranial nerves (IX,X,XI, & XII)

hematomas compromising the airway, direct vascular injury with subsequent occlusion, and bullet embolization.¹⁷ Mortality from these injuries ranges from 5% to 50%.^{2,4,13,15} The clinical features of a vascular injury may be quite obvious, such as pulsatile bleeding or an expanding hematoma. These signs, believed to demonstrate a definite vascular injury, are referred to as “hard signs”.^{2,13} (See Table 2.) Vascular injuries also may present with subtle neurologic or pulse deficits, therefore, a rapid yet vigilant exam is necessary. Late complications include traumatic aneurysm and arteriovenous fistula.⁵

Laryngotracheal injuries complicate 10% of penetrating neck injuries.^{15,17} With penetrating trauma, these injuries are rarely occult.³ The most common signs and symptoms include dyspnea, stridor, dysphonia, hemoptysis, laryngeal tenderness, subcutaneous emphysema, and air bubbling from the wound.^{2,3,13,15} (See Table 3.) Any of the above findings mandate laryngoscopy.

Esophageal injury occurs less frequently than vascular or laryngotracheal injuries due to the relatively protected location of the esophagus.¹⁷ Some authors have noted dyspnea, hemoptysis, and air-bubbling through wounds as “hard signs” of aerodigestive tract injuries.¹⁸ Most esophageal injuries are associated with laryngotracheal injuries due to its location.⁵ Signs and symptoms of esophageal injury include dysphagia, oropharyngeal hemorrhage, nasogastric tube bleeding, subcutaneous emphysema, and resistance to movement of the neck. As with laryngotracheal injuries, crepitation is a strong indicator of esophageal injury.^{2,3,4,17-19} (See Table 4.) Despite these signs, esophageal injuries are the most commonly missed injuries in the neck.^{17,20} A delay in the diagnosis of these injuries increases mortality.¹³ An early diagnosis is required to pre-

Figure 3. Zones of the Neck

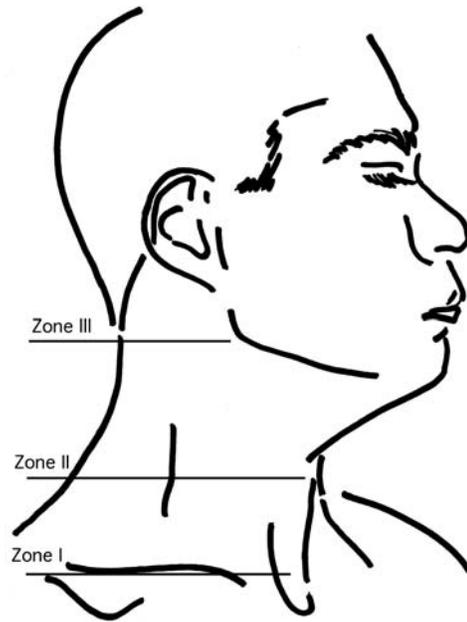


Illustration courtesy of Marcus Eubanks, MD.

Figure 4. Penetrating Trauma to Zone I of the Neck



Figure 4. A patient who presented following penetrating trauma to zone I of the neck.

Figure courtesy of Howie Werman, MD, FACEP, Professor of Clinical Emergency Medicine, The Ohio State University College of Medicine and Public Health; Medical Director, Med-Flight, Columbus, OH.

vent the development of mediastinitis due to para-esophageal contamination.

Injuries to the nervous system include direct spinal cord injury, cranial nerve injury, peripheral nerve injury, and

Table 2. Clinical Features of a Vascular Injury

HARD SIGNS OF ARTERIAL INJURY

- Pulsatile bleeding
- Expanding hematoma
- Palpable thrill
- Bruit
- Findings of cerebral ischemia
- Findings of peripheral ischemia in upper limb
 - Pulselessness
 - Pallor
 - Paralysis
 - Poiklothermia
 - Pain

deficits in the central nervous system. Approximately 10% of patients with penetrating neck trauma will have an associated spinal cord or brachial plexus injury.¹³ The clinical presentation will depend upon the involved structure and the extent of the injury. In a recent study, almost 10% of asymptomatic patients with gunshot wounds to the trunk, head, or neck had spinal injuries.²¹ This percentage is much higher than had been reported in previous studies, and its results have been challenged.^{22,23} In Connell's study, no spinal injuries were found among nonintoxicated patients with a normal neurological examination who had penetrating trauma.²² Also, the presence of a peripheral nerve injury should alert the evaluating personnel to the possibility of an associated arterial injury because most nerves are located close to large arteries.⁵

Diagnostic Studies

A successful diagnostic approach to penetrating neck injury must include evaluation of the three individual organ systems: vascular, laryngotracheal, and para-esophageal. Also, the nervous system, such as the spinal cord/column and nerves and nerve root, must be evaluated. The venous structures that may be potentially injured include the internal and external jugular veins along with the subclavian veins. Arteries at risk of injury include the carotid, subclavian, and vertebral arteries. The vertebral artery is the least injured due to its well-protected position.^{13,17} Visceral structures with injury potential are the pharynx, larynx, trachea, esophagus, and pleural cavity.

If the integrity of the platysma muscle is not compromised throughout the entire wound and the physical examination is otherwise normal, one can assume no serious penetration occurred. No further tests need be performed to detect internal injury due to penetrating trauma. Any violation of the platysma indicates penetrating neck trauma has occurred and mandates both surgical consultation and further diagnostic evaluation. The hemodynamically unstable patient may require immediate operative exploration. As discussed in the historical perspective, the management has

Table 3. Clinical Features of Laryngotracheal Injury

- Hoarseness/ altered voice
- Anterior neck pain / tenderness
- Hemoptysis
- Stridor
- Subcutaneous emphysema / crepitance
- Deformity of neck landmarks
- Air bubbling from wound

Table 4. Clinical Features of Esophageal Injury

- Dysphagia
- Oral bleeding / nasogastric tube bleeding
- Anterior neck pain / tenderness
- Subcutaneous emphysema / **crepitance**
- Resistance to range of motion of the neck

evolved from mandatory exploration to a more selective management if the patient is stable.^{2,13} This evolution has not been without controversy. Some authors have advocated a mandatory exploration of all significant penetrating neck trauma to avoid missing any important injuries. This approach yields a range of 30% to 89% negative explorations.²⁴⁻²⁸ This high negative exploration rate has produced the selective management of penetrating neck trauma. Currently, the controversy focuses on the selection of diagnostic testing needed to exclude the potential injuries.¹³ The choice of diagnostic tests will depend upon the resources available at an individual institution.

Advanced imaging technologies have enabled the detection of vascular and other injuries in penetrating neck trauma. Diagnosing vascular injuries remains paramount in penetrating neck trauma. Angiography has traditionally been considered the gold standard in evaluating such injuries (*Figure 5*). However, it is an invasive study and is not without risk. At the other end of the diagnostic spectrum, some have advocated the use of physical examination alone. Generally, it is believed to be insufficient.²⁹ Bishara documented that almost 25% of vascular injuries were missed when relying on physical examination alone.²⁹ Mohammed and colleagues reported a negative predictive value of 67% for the absence of signs of vascular injury on physical exam in patients with gunshot wounds to the neck.³⁰ Diagnostic studies are clearly required to exclude potentially life-threatening injuries. Recently, noninvasive techniques have emerged, such as computed tomographic angiography (CTA), magnetic resonance angiography (MRA), and color flow ultrasound (US).

In patients who are not deemed to require emergent surgical intervention, four main imaging modalities are considered: angiography, MRA, US, and CTA. MRA has been

Figure 5. Common Carotid Arteriogram in a Patient with a Zone III Penetrating Injury of the Neck



Figure 5. A 22-year-old man with gunshot wound to zone III right neck in whom neurologic examination findings were normal. Lateral view from common carotid arteriogram confirms total occlusion (arrow) of internal carotid artery.

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Figure 6. MR Imaging of Zone II Penetrating Trauma

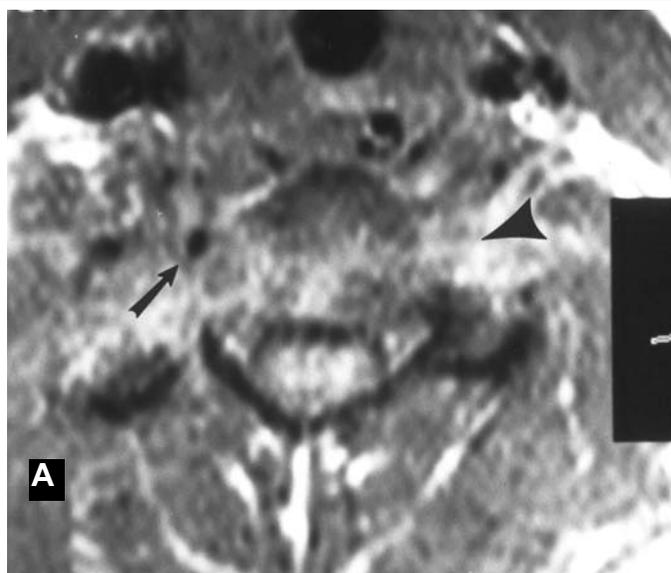


Figure 6A. A 14-year-old boy with gunshot wound across zone II who presented as C4-level quadriplegic. Axial T1-weighted MR image shows horizontal fracture extending through vertebral body and both transverse foramina. Note normal signal void in right vertebral artery (arrow) but lack of flow void in region of left vertebral artery (arrowhead).

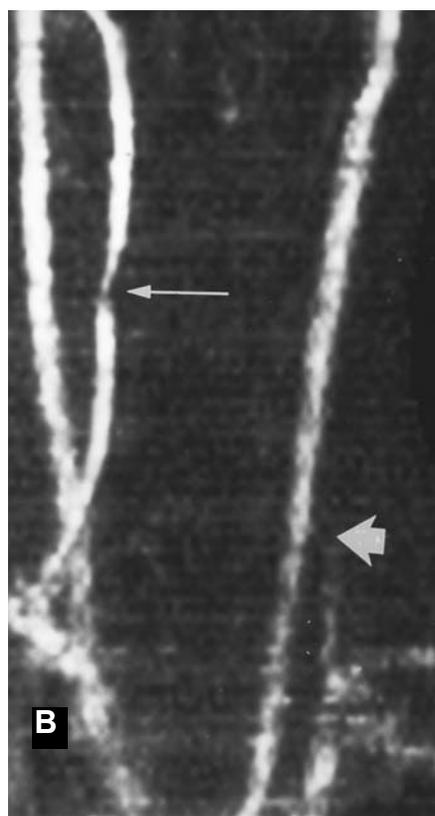


Figure 6B. A 14-year-old boy with gunshot wound across zone II who presented as C4-level quadriplegic. Coronal maximum-intensity-projection image from two-dimensional time-of-flight MR angiogram, acquired with axial slices, reveals absent flow-related enhancement of left vertebral artery beyond origin consistent with occlusion (short arrow). Also note external compression of right vertebral artery at level of fracture (long arrow).

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used for imaging vascular injuries. However, it is limited in the assessment of bony structures. In addition, it is not practical in the acute assessment of the trauma patient because of the need for proper monitoring and MR-incompatible equipment. The availability of emergent MR also is limited in many hospitals and trauma centers. Thus, MRA will not be further discussed. However, MR/MRA (Figure 6) remains a potential diagnostic modality if it becomes more efficient and more readily available.

Color flow US offers a viable noninvasive alternative to angiography. US allows a noninvasive evaluation of the vascular bundles and adjacent tissue and a real-time analysis of blood flow velocity (Figure 7). US, like MRA, does have several significant limitations: It requires a trained technician and is highly operator dependent. In many hospitals, US is not available at night or on weekends. Imaging artifact may be generated by bone, and examination of smaller arterial branches may cause errors. Studies have been promising in the use of US, however, and its sensitivity was approximately 90%-91% compared with angiography, and its specificity was 100%.³¹ Positive predictive value was found at 100%, and negative predictive value was 99%.³¹ In spite of these encouraging numbers, the limited availability of US and the inter-operator variability make US less feasible in the reliable evaluation of vascular injury in penetrating neck trauma. Also, US may be misleading in zone III due to artifact.³²

Helical CT angiography has been studied at several centers and has shown very promising results (Figure 8). Its sensitivity and specificity compared with angiography was 90%-100%. Munera and colleagues demonstrated a sensitivity of 90%, specificity of 100%, positive predictive value

Figure 7. Sonogram of Penetrating Trauma to Zone II of the Neck

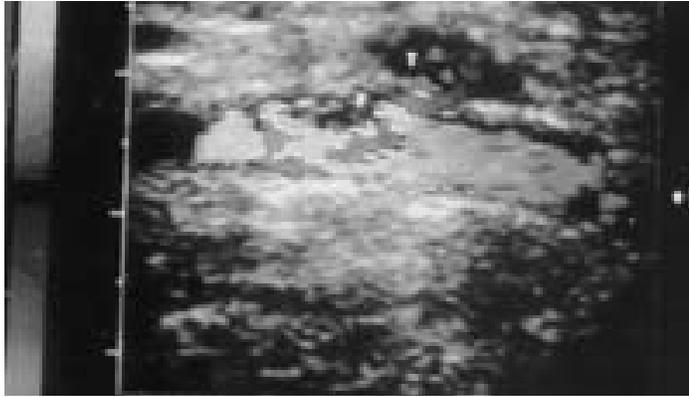


Figure 7 A 59-year-old man who attempted suicide by gunshot to zone II left neck. Longitudinal color sonogram of left common carotid artery shows pseudoaneurysm (PSA) with partial thrombus (T) and intimal flap (F).

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Figure 8. Penetrating Trauma to Zone III of the Neck

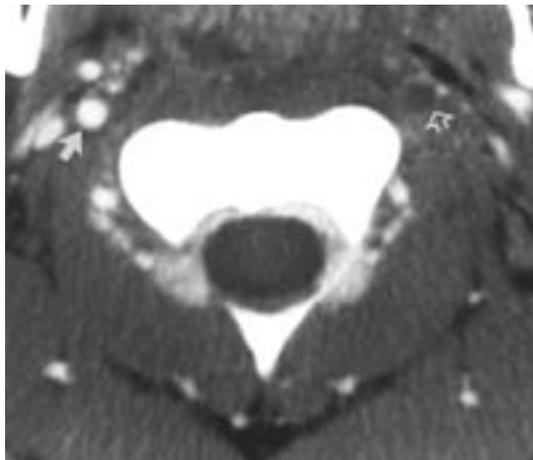


Figure 8. A 22-year-old man with gunshot wound to zone III right neck in whom neurologic examination findings were normal. Axial helical CT angiogram reveals normal enhancement in right internal carotid artery (solid arrow) and no enhancement in region of left internal carotid artery (clear arrow), indicating occlusion.

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of 100%, and a negative predictive value of 98%.³³ Several other studies have shown similar results making helical CT angiography an attractive alternative to standard angiography.³⁴⁻³⁶ In addition, CT may reveal aerodigestive injuries, bony injuries, and the tract of the bullet. When combined with physical examination, CT can reveal damage to the spinal column and spinal cord (Figure 9). There is no evi-

Figure 9. Axial Helical CT Angiogram

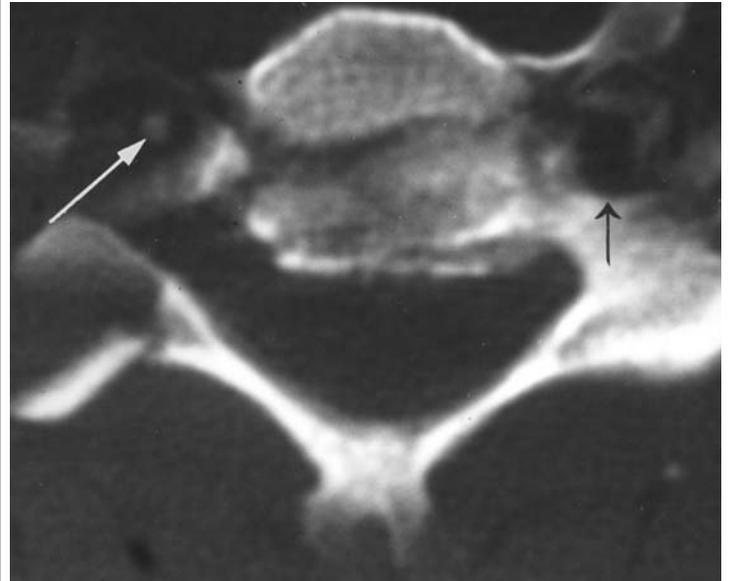


Figure 9. A 14-year-old boy with gunshot wound across zone II who presented as C4-level quadriplegic. Axial helical CT angiogram filmed in bone windows shows path of bullet and fractures across C4 vertebral body involving both transverse foramina. Note contrast-enhanced right vertebral artery (white arrow) and nonvisualization of left vertebral artery (black arrow) in left transverse foramen.

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dence that a negative CT study will exclude aerodigestive injuries, although it may sometimes diagnose these injuries. Some of the limitations of CTA include motion and foreign body artifact. Vascular abnormalities or congenital anomalies may be confused with pathologic lesions. Subclavian arteries may not be adequately visualized due to the imaging plane in some CT scanners, but greater spatial resolution in machinery is overcoming this deficit. Small lesions of questionable significance may be missed. Lastly, CT imaging is only diagnostic, and not therapeutic such as angiography. Nevertheless, CT imaging to detect vascular injuries remains an excellent choice in the initial assessment of vascular injury in penetrating trauma (Figures 10 and 11). Depending on the CT result, angiography may be indicated for confirmatory testing or intervention.

Evaluation of the aerodigestive structures of the neck, specifically the laryngotracheal and para-esophageal systems, requires the same rigorous approach as mandated for vascular injury. Injuries may be silent initially, and serious complications can result. Careful clinical examination remains the focal point in the diagnosis of aerodigestive tract injuries. Demetriades and colleagues propose that in awake, alert patients who are able to be evaluated clinical-

Figure 10. Penetrating Trauma of Zone I and II of the Neck

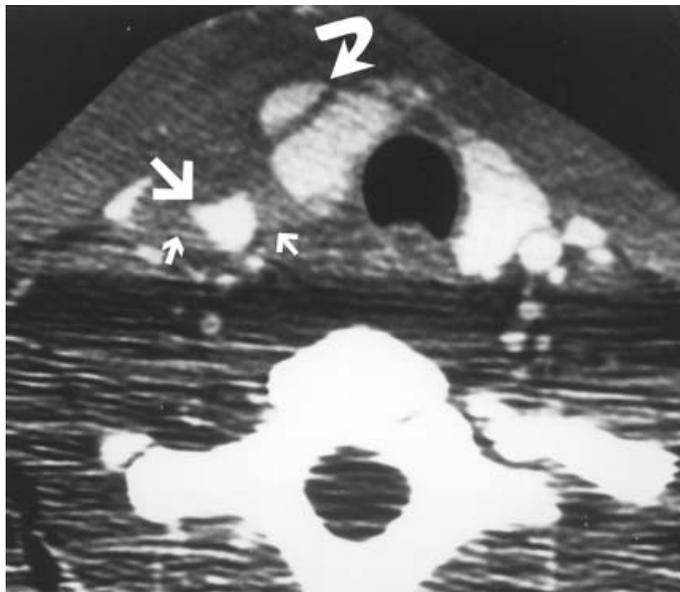


Figure 10. A 21-year-old man who presented with stab wound to right neck traversing zones I and II. Axial slice from helical CT angiogram reveals irregular contour of proximal right common carotid artery with contrast material extending outside confines of vessel lumen (large straight arrow) corresponding to site of pseudoaneurysm formation. Note hematoma surrounding artery (small arrows) and fracture through right lobe of thyroid gland (curved arrow).

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ly, physical examination alone can exclude or raise suspicion for significant injuries.³⁷ In another study, all patients eventually proven to have an injury to aerodigestive structures were initially symptomatic.¹⁷ In a study with contrarian results, Gonzales and colleagues reported 4 esophageal injuries that were missed by a combination of physical examination and helical CT study.³⁸

As in vascular injury, a chest and lateral neck radiograph should be a standard initial tool in the aerodigestive system evaluation. Flexible fiberoptic endoscopy is the desired modality for identifying laryngotracheal trauma. CT scanning of the neck can reveal laryngeal structural damage and fractures and dislocations of bone and cartilage. However, a negative CT study does not exclude aerodigestive injury. The evaluation of the esophagus and pharynx is not as straightforward as the laryngotracheal system. While the evaluation of the pharynx can be done via direct endoscopy with satisfactory results, the cervical esophageal evaluation remains much more complex, especially compared with the thoracic and abdominal esophagus. Flexible endoscopy has a lower sensitivity in the cervical region than compared with other esophageal areas, thus injuries may be missed in

Figure 11. Axial Helical CT Angiogram of Patient with a Dog Bite to the Neck

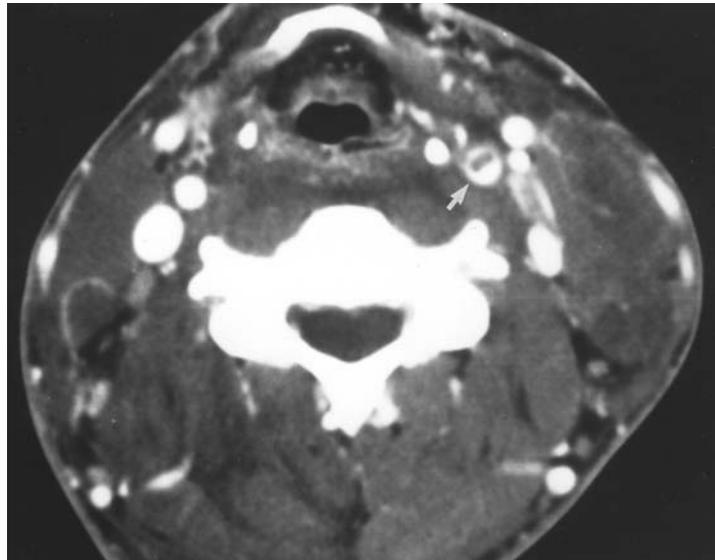


Figure 11. A 34-year-old man who presented with a dog bite to zone II of left neck. Axial helical CT angiogram shows focal filling defect in left common carotid artery (arrow).

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this area. Radiological imaging may be performed in the form of a swallow study or, in the case of intubated patients, with contrast injected via a tube. Sensitivities vary widely in radiological imaging from 60% to 100%, while sensitivity with endoscopy ranges in the 80th percentile in the cervical esophagus.³⁹⁻⁴² Rigid endoscopy provides a higher sensitivity, but it must be done by experienced operators under general anesthesia. The combination of endoscopy and esophagoscopy has a synergistic ability to diagnose para-esophageal injuries. Demetriades and colleagues recommend this approach in the evaluation of the pharynx and esophagus in penetrating neck trauma.³⁷

As previously mentioned, literature in the management of pediatric penetrating neck injury is sparse. One retrospective study done by Abujamra and Joseph examined 31 children with penetrating neck trauma.¹⁰ Most had only minor physical examination findings and did not merit exploration or diagnostic imaging. Observation alone was sufficient for the stable patient. Larger multicenter studies are needed before specific conclusions can be made; however, currently, the overall management of penetrating cervical injuries in children should follow the adult guidelines above.

Management

The initial management of a patient with penetrating neck trauma is similar to any potential major trauma patient. Of primary concern in a patient with this type of injury is airway compromise and extensive bleeding. The

Table 5. Absolute Indications for Mandatory Exploration

- Airway compromise
- Extensive subcutaneous emphysema
- Pulsatile hematomas
- Shock or active, uncontrollable bleeding

status of the airway can deteriorate precipitously due to edema and bleeding. The primary survey is rapidly performed with concurrent evaluation and management using a team approach if such resources are available. Supplemental oxygen should be provided, monitoring performed, and vascular access should be established. This access should be established on the opposite side of the injury.

Airway and Breathing

Airway management in penetrating neck injury patients is potentially very problematic. Approximately 10% of these patients will present with airway compromise, either partial or complete.⁵ There is not a universal consensus for either the indications for active airway management or the appropriate technique. The emergency medical literature in this area is somewhat scarce.

Orotracheal Intubation. Early intubation has been the rule if there is any question of airway compromise or anticipated problems. Orotracheal intubation using a rapid sequence intubation (RSI) technique is the method of choice in most patients with penetrating neck trauma. Concerns with using RSI in the patient with a neck injury include the difficulties or failure to intubate due to anatomic distortion and the potential conversion of a partial laryngotracheal injury into a complete transaction.⁴³ Mandavia and colleagues reported a 100% success rate with this technique.⁴³ Awake intubation is often recommended due to these potential complications. Despite these concerns, in one retrospective study, three cases had failure of fiberoptic intubation, yet these patients were successfully intubated using an RSI technique.⁴³

Nasotracheal Intubation. Nasotracheal intubation has been relatively contraindicated in penetrating neck trauma due to concerns of dislodging a hematoma and lack of visualization of the airway. A prehospital study demonstrated a 90% success rate in a well-trained emergency medical services system.⁴⁴ Also, these patients did not experience any complications related to this technique of airway management.⁴⁴ Despite previous concerns, blind nasotracheal intubation may be a reasonable alternative for airway management by appropriately trained personnel in patients with penetrating neck trauma. Further study in this area is required.

Fiberoptic Intubation. Fiberoptic intubation may be considered in the management of these patients. This technique is time consuming and difficult if the airway is bloody. Awake fiberoptic intubation is considered the safest

technique in cooperative patients with suspected airway injury at some trauma centers.⁴⁵ Desjardins reports that his trauma center uses a rapid sequence technique with fiberoptic intubation in uncooperative patients who did not appear difficult to intubate.⁴⁵

Direct Intubation. Direct intubation into the distal segment of an injured larynx may be possible in penetrating trauma. The trachea is held with hemostats, tracheal hook, or towel clip, and the endotracheal tube is placed directly into the trachea. Placement of an endotracheal tube through the wound is not universally successful depending upon the characteristics of the wound. A gum elastic bougie has been used to establish the airway through the wound in such a case.⁴⁶ This device is usually used as an airway adjunct when the laryngoscopic view is suboptimal. The bougie is passed to the cords without direct visualization. If it finds the trachea, a clicking can be felt from the tracheal rings. This device also may become caught at the carina, and the resistance ensures tracheal insertion.⁴⁶

Cricothyrotomy. Cricothyrotomy may be used as a rescue method if the injury is above the level of the cricothyroid membrane. Also proceed with this technique if the patient's condition does not allow time for a tracheostomy.

Tracheostomy. Tracheostomy may be used as a rescue method and usually will be performed by surgical colleagues. It should be performed at least one tracheal ring below the level of the injury.⁴⁵

The method of stabilizing the airway will depend upon the skills of the practitioners available, the condition of the patient, and the resources of the institution.

Circulation: Hemorrhage Control. Direct pressure is used to control bleeding. Clamping of vessels should be discouraged. Wounds should be covered with an airtight dressing because lacerations involving the venous system may lead to air embolus.² Fluid resuscitation and blood product replacement should follow standard guidelines.

Diagnostic Strategies

After stabilization, the initial key question is: Does the wound penetrate the platysma? If the answer is yes, a surgical consultation is mandatory. (The penetration of the platysma defines penetrating neck trauma.) The next question is: Should these wounds be managed with mandatory operative exploration or selective operations? The approach will vary by hemodynamic stability, the zone involved, mechanism of injury, and institution. Definite signs and symptoms of vascular or aerodigestive injuries requires urgent operative intervention.^{4,13} (See Table 5.)

Unless the patient is very unstable, zone I and zone III injuries are managed selectively due to the difficulties in examining these areas as well as obtaining good intra-operative exposure.¹³ The controversy primarily concerns the management of a stable patient with a zone II injury and no significant symptoms. Most experts favor selective management over mandatory exploration.^{4,13} All such patients

should have a chest x-ray and soft-tissue neck radiography both anterior-posterior and lateral views in addition to the routine trauma laboratory studies. Patients with zone I injuries often have an associated pneumothorax or hemothorax. After these initial tests are performed and stabilization is obtained, the management of the stable patient with penetrating neck trauma proceeds based upon the involved zone, the mechanism, and the resources available.

Stable patients with a zone I injury require studies of the great vessels, airway, and esophagus. An arteriogram is performed to exclude great vessel injury. Bronchoscopy will identify laryngotracheal injuries. The combination of esophagram and esophagoscopy may evaluate potential esophageal injuries.

A stable patient with a zone II injury may require studies of the great vessels, airway, and esophagus. These patients are managed based on the mechanism and the presence of signs or symptoms of injury. A patient with transcervical wounds (wounds that cross the midline) is explored if symptomatic and undergoes selective management if asymptomatic. Some trauma centers practice expectant management of asymptomatic zone II injuries caused by stab wounds or low-velocity gunshot wounds.¹³ Patients with zone II injuries have a lower mortality rate because the access for surgical exploration is good and direct pressure can control hemorrhage.⁴⁶

A stable patient with a zone III injury requires studies of the cerebral circulation, upper airway, and esophagus. Ferguson and colleagues have questioned the need for an angiogram in patients with zone III injuries lacking hard signs of vascular trauma.⁴⁷ All symptomatic patients with zone III injuries require diagnostic evaluation of the esophagus and arteries.²

Disposition

All patients with penetrating neck wounds—which by definition violate the platysma—require admission to a qualified surgeon with appropriate resources, preferably at a trauma center. A facility that does not have adequate resources should have transfer guidelines in place with a trauma center to facilitate transfer. ED physicians should be familiar with their facility's resources and should transfer patients, following stabilization, as appropriate.

Summary

Injuries to the neck present a difficult challenge in both diagnosis and management (*See Table 6*). Successful management requires a thorough understanding of the complex anatomy of the neck. Clinical presentations and physical examination findings also must be reviewed. Some injuries may present dramatically and catastrophically, while others may be more insidious. A thorough and structured approach must be implemented for every patient.

The controversy over mandatory exploration versus selective, nonoperative management is being replaced by

Table 6. Pearls and Pitfalls

- Never clamp vessels in the neck.
- Don't probe neck wounds.
- Don't remove impaled objects.
- Earlier intubation is often the safest choice.

discussion about the optimal nonoperative strategy for each zone realizing which structures are at risk for injury. Selective evaluation is based on the symptoms and physical findings, unlike routine imaging in which all patients undergo a complete battery of studies. The diagnosis of injuries in penetrating neck trauma should focus on evaluating vascular, laryngotracheal, and esophageal trauma. Spinal cord and other nervous system trauma must not be overlooked, although there is some controversy about its prevalence.²¹⁻²³ Similar to adults, the selective management of penetrating neck injuries is a safe, effective strategy in the pediatric population in an experienced pediatric trauma center.⁴⁸

Angiography remains the gold standard for vascular injury diagnosis, but newer imaging modalities—primarily helical CT angiography—provide an excellent alternative for initial screening and soon may become the primary imaging modality. MRA and US offer comparable results, but these diagnostic tools are not as practical in the acute injury setting due to operator dependency and limited after-hours availability. Aerodigestive injury can be suggested from physical examination findings, but the combination of endoscopy and esophagography along with bronchoscopy provides a reliable diagnostic modality to identify or rule out esophageal and laryngotracheal injury.

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CNE/CME Objectives

Upon completing this program, the participants will be able to:

- a.) discuss conditions that should increase suspicion for traumatic injuries;
- b.) describe the various modalities used to identify different traumatic conditions;
- c.) cite methods of quickly stabilizing and managing patients; and
- d.) identify possible complications that may occur with traumatic injuries.

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CNE/CME Instructions

Physicians and nurses participate in this continuing medical education/continuing education program by reading the article, using the provided references for further research, and studying the questions at the end of the article. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material. **After completing this activity, you must complete the evaluation form provided and return it in the reply envelope provided in order to receive a letter of credit.** When your evaluation is received, a letter of credit will be mailed to you.

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CNE/CME Questions

1. Which of the following anatomical areas of the neck is the most common site of injury in penetrating neck injuries?
 - A. Zone III
 - B. Zone II
 - C. Zone I
 - D. Posterior triangle
2. Which of the following is the most commonly missed significant injury in penetrating neck trauma?
 - A. Spinal fracture
 - B. Carotid dissection
 - C. Jugular vein laceration
 - D. Esophageal injury
3. Which of the following anatomical areas of the neck has the highest mortality in penetrating neck injuries?
 - A. Zone III
 - B. Zone II
 - C. Zone I
 - D. Posterior triangle
4. Which of the following is a "hard sign" of vascular trauma?
 - A. History of extensive bleeding at the scene
 - B. Nonexpanding hematoma
 - C. Palpable thrill
 - D. Extensive associated injuries

5. Which of the following arteries is most commonly injured in penetrating neck trauma?
 - A. Common carotid artery
 - B. Vertebral artery
 - C. Subclavian artery
 - D. Internal Carotid artery
6. Which of the following injuries is most likely to be associated with a zone I injury to the neck?
 - A. Vertebral artery transection
 - B. Esophageal tear
 - C. Hemothorax
 - D. Salivary gland injury
7. Which of the following statements regarding airway management in a patient with penetrating neck trauma is most true?
 - A. Cricothyrotomy is recommended.
 - B. Nasotracheal intubation is absolutely contraindicated.
 - C. There is no clear consensus on airway management.
 - D. Noninvasive airway management is preferred over endotracheal intubation.
8. What of the following procedures is the most appropriate step in a neck wound that does not penetrate the platysma and is located in zone II in a patient without other symptoms?
 - A. Local wound care
 - B. Helical CT study
 - C. Angiography
 - D. Esophagram
9. What are the anatomical boundaries of zone I regarding penetrating neck trauma?
 - A. Between the cricoid cartilage and the angle of the mandible
 - B. Extends from the sternal notch to the cricoid cartilage
 - C. Above the angle of the mandible to the base of the skull
 - D. Below the sternal notch
10. Which of the following characteristics is an advantage of color flow ultrasound compared with angiography?
 - A. Readily available
 - B. More accurate in zone III
 - C. Noninvasive
 - D. Better evaluation of smaller arterial branches

Answers: 1. B; 2. D; 3. C; 4. C; 5. A; 6. C; 7. C; 8. A; 9. B; 10. C

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in the pediatric
trauma patient**



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