



# Review on Clinical Forensic Medicine

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## Abstract

Forensic medicines, clinical forensic medicine, and forensic pathology such terms are utilized across the globe. Clinical forensic medicine is also a branch of medicine which involves living individuals and working together with law, judiciary, and police personnel. In the more extensive sense, clinical forensic medicine implies the use of clinical information and abilities to living people relating to the uncommon necessities of the particular legitimate, legal, and police frameworks. It is significantly important that the forensic physicians should be trained, experienced, and qualified. Clinical forensic medicine has been challenged to contribute its role with the legal framework to expand the resources accessible to those patients associated with liability-related injuries, victims of a crime, or any perpetrator, suspect, and a criminal in police custody. Individuals suffering from trauma which is associated with a criminal activity often demand the enquiry of the injuries, and they are looking for well-trained, skilled, and experienced forensic pathologists. Specialists are capable enough to assess the surviving victims of sexual assault, domestic violence, related with liability

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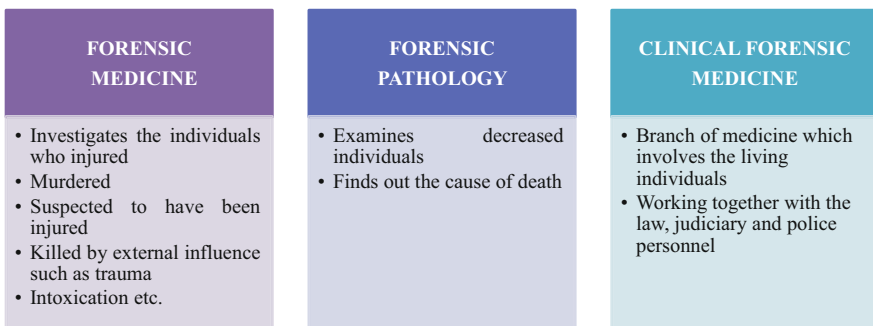
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injuries, pseudo victimization, self-harm, child abuse, etc. In this chapter, all the cases dealt in the clinical forensic medicine have been reviewed.

## 9.1 Introduction

Forensic medicine, clinical forensic medicine, and forensic pathology such terms are utilized across the globe [1]. Forensic medicine is defined as the branch of medicine which investigates individuals who have been either injured or murdered or suspected to have been injured or killed by external influence such as trauma, intoxication, etc. People with nonfatal wounds after purposefully self-incurred or accidental wounds are, then again, as a rule, taken care of solely inside the medical services framework. In numerous nations, forensic medicine addresses a clinical strength inside the general set of laws, not inside the medical services framework. “Forensic pathology is defined as the branch of Medicine applying the principles and facts of the medical sciences to the issues in the field of law.” On the other hand, forensic pathology examines deceased individuals and finds out the cause of death [2, 3]. Clinical forensic medicine is also a branch of medicine which involves living individuals and working together with law, judiciary, and police personnel. This term is exploited since 1951 when the Association of Forensic Physicians (earlier known as Association of Police Surgeons; UK-based body) was launched and has become popular in the last two or three decades. And the practitioners involved in this field are known by several names, but the most accepted term is forensic physician. Practitioners in forensic pathology are called forensic pathologists dealing with deceased individuals. On the other hand, practitioners in the clinical forensic medicine are called forensic physicians which deal with living individuals. There are several doctors across the world which are involved in the field of clinical and pathological aspects of forensic medicine [1] (Fig. 9.1).



**Fig. 9.1** Showing the basic description about forensic medicine, forensic pathology and clinical forensic medicine

### 9.1.1 Relationship Between Clinical Forensic Medicine and Forensic Medicine

The application of clinical knowledge and practices to living persons subsequent to the specific requirements of respective legal, judicial, and police systems is defined as clinical forensic medicine. On the other hand, forensic medicine is one of the significant branches of forensic science which is also known as “legal medicine,” “medical jurisprudence,” and “forensic pathology,” applying the principles and skills in civil and criminal law. Both clinical and forensic medicine apply their knowledge and skills in the legal and judicial system and present in the court of law.

The most common of the cases among clinical forensic medicine and forensic pathology/forensic medicine are listed below:

1. Injuries
2. Trauma—sharp as well as blunt force
3. Sexual assaults
4. Road traffic accidents
5. Bomb blast cases
6. Strangulation

### 9.1.2 Clinical Forensic Medicine

In the more extensive sense, clinical forensic medicine implies the use of clinical information and abilities to living people relating to the uncommon necessities of the particular legitimate, legal, and police frameworks. The association of clinical legal work varies extensively from one place to another, part of the way relying upon the legal. Table 9.1 show all the categories of work and responsibilities which are dealt and handled in the clinical forensic medicine by several specialists of various disciplines such as legal medicine, pediatrics, gynecology, psychiatry, public health, emergency medicine, etc. [5].

Victims of a crime or suspected culprits sometimes have to be assessed with respect to the presence of injuries. The medical findings and the clinical report on the injuries are likely to have a significant impact in any resulting legal procedures. So, the actual assessment and the documentation of the applicable outcomes should be acted in an accurate manner. Portrayals and conclusions ought to be stated in wording which is additionally understandable to lay people. There should be an explanation of the reports if the scientific language is unavoidable [4].

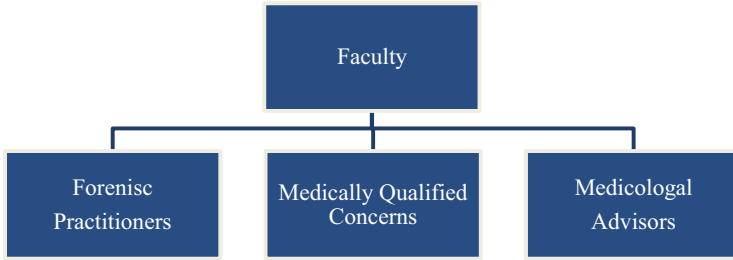
The following are the things which need to be considered while dealing with living victims in clinical forensic medicine:

1. Documentation should be in an adequate and accurate manner.
2. Assessment of case if it requires sample collection in circumstances like alcohol/drug intake, genital swabs, hair samples, etc.

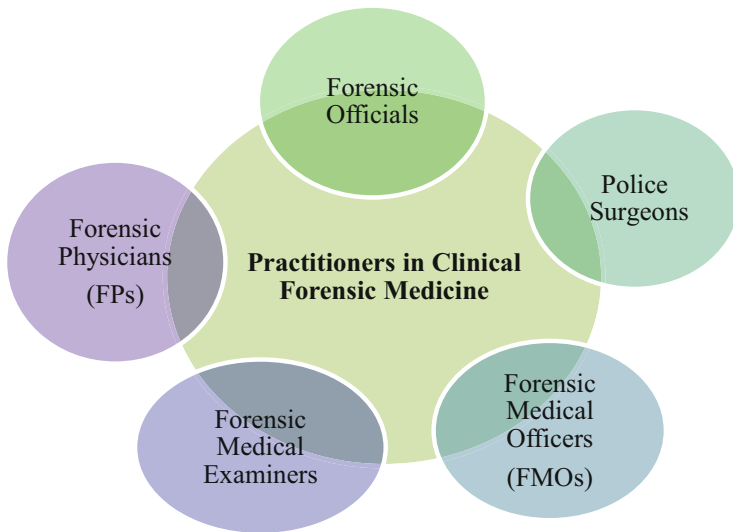
**Table 9.1** Categories of duties in clinical forensic medicine [4]

S. No.	Category	Dealing with
1.	Assessment of live victims	<ul style="list-style-type: none"> <li>• Body injury</li> <li>• Rape/sexual assault</li> <li>• Marital rape</li> <li>• Domestic violence</li> <li>• Child abuse</li> <li>• Abuse of elderly individuals</li> <li>• Torture</li> </ul>
2.	Assessment of suspected perpetrators	
3.	Assessment of injuries	<ul style="list-style-type: none"> <li>• Self-inflicted injuries</li> <li>• Accidental injuries</li> </ul>
4.	Medical examination in traffic accidents	<ul style="list-style-type: none"> <li>• Examination of driver and passengers</li> <li>• Examination of pedestrians</li> </ul>
5.	Examination for fitness to drive	Examination of disability due to alcohol and/or drug intake Sample collection (blood)
6.	Assessment of effects	Alcohol and drugs
7.	Assessment of mental health	
8.	Assessment of fitness to be detained and interrogated	
9.	Assessment of physical capacity needed to perform work	
10.	Reports declaration and capability	<ul style="list-style-type: none"> <li>• Documentation of all medical findings and observations in well and proper manner</li> <li>• Determination of wounds and injuries and other medical evidences</li> </ul>
11.	Presenting the medical evidences in the court of law	<ul style="list-style-type: none"> <li>• Witness</li> <li>• Professional witness</li> <li>• Expert witness</li> </ul>
12.	Medical concern of convict	<ul style="list-style-type: none"> <li>• Police custody</li> <li>• Prison custody</li> </ul>
13.	Age determination	
14.	Healthcare of police officials	

3. Photography of medical observations, if necessary, for example, in the complex and patterned injuries.
4. Detailed recording of injury marks, etc. should be done because there can be self-inflicted injuries or absence of injuries in false allegations.
5. Medical reports must comprise all the basic details of the victims such as size, height/stature, body weight, etc.
6. Details of injuries and wound reporting the size, shape, and appearance with respect to the location, etc. of wound must be imprinted.
7. Diagrams and sketches of the body might be helpful.
8. Close assessment and accurate depiction of wounds and injuries should be done.
9. The condition of wounds/injuries must be assessed properly if there is any sign of repair or infection or it requires any surgical treatment.



**Fig. 9.2** Faculty professional groups [6]



**Fig. 9.3** Showing the different titles for the practitioners in clinical forensic medicine

10. Terms and description should be easily understandable to the lay people. If scientific language is not understood, then an explanation should be given [4] (Fig. 9.2).

### 9.1.3 Role of Forensic Physician (FP)

It is significantly important that the forensic physicians should be trained, experienced, and qualified. Forensic practitioners are doctors who are serving in the field of clinical forensic medicine and providing medical treatment and care to clients and assessment of victims in cases of sexual assault, rape/marital rape, domestic violence, and also assessment of detainees. They are also eligible for giving expert opinion in suspicious cases of death [6] (Fig. 9.3).

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### **9.1.4 Clinical Forensic Medicine in the Emergency Department: Common Errors and Need**

The techniques of forensic medicine which are usually applied on the dead are also utilized on the living in clinical forensic medicine. Medical findings are recorded, injuries are assessed, documentation in the emergency department is conducted, and all the essential evidentiary material is collected for presentation in the court of law. There can be some common forensic errors consisting of the inability to identify, collect, and preserve the evidentiary materials in the emergency department. Other common errors may include failure in the recognition of type of injuries, patterned injuries, ballistics examination, and sharp, blunt or any penetrating injuries. Such common errors further may cause difficulties to access significant information and evidence. Proper training should be provided in the emergency department of clinical forensic medicine to address the forensic requirements which is implemented in the emergency medicine residency program at University of Louisville and serving the desired forensic assessments and examinations. The progress and training in the field of clinical forensic medicine is unique at the international level [7].

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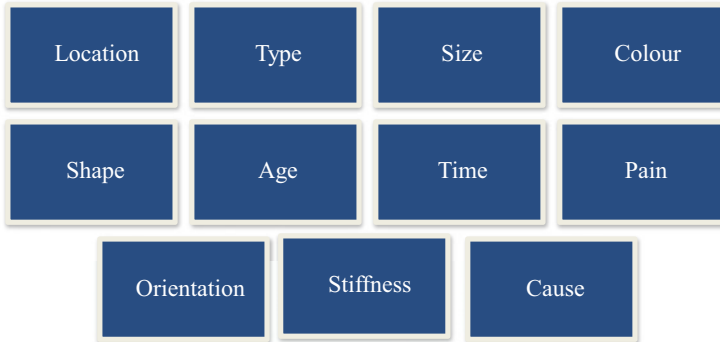
## **9.2 Cases Dealt in the Clinical Forensic Medicine**

### **9.2.1 Injuries: Assessment and Documentation**

The assessment of living persons in the last few years has been recognized as “clinical forensic medicine” which is one of the classical fields of forensic medicine. Usually, forensic analysis of injuries follows the same morphological principle, facts, and knowledge whether in living (clinical forensic medicine) or dead (forensic medicine) persons. But there are some unique and specific features which are used to distinguish and differentiate between the homicidal, accidental, or self-inflicted origin. In the forensic medical context, the injury is defined as “damage to any part of the body caused by the intentionally or accidentally via using any mechanical or some other traumatic agent.” The role of the forensic physician is to assess, document, and interpret the injuries appropriately and accurately to find out how that wound or injury was caused which might often found as an issue in the court of law [8, 9].

#### **9.2.1.1 Injury Assessment**

Appropriate assessment and interpretation of an injury lies upon the well and good physical examination, ascertaining a good history, and documenting and recording the medical findings clearly whether in the form of notes, body charts, computer records, etc. which will be evaluated by the doctors, legal authorities, and courts further. The consent of the individual who is being examined should be obtained for generating a medical report [8].



**Fig. 9.4** Information required for injury assessment [8]

There are so many key factors associated in the successful assessment of injuries which are listed as below:

- How did the injury sustain?
- Any weapon used? If yes, then still available?
- What was the time when the injury sustained?
- Any protocols followed for the treatment of injury?
- Previous record, if there is any illness present such as any skin disease or allergy.
- Any medication used regularly.
- Alcohol and drug intoxication.
- Outfits worn.

There is also some other more of the information required for the assessment of injuries like (Fig. 9.4):

### 9.2.1.2 Documentation

Forensic injury or wound documentation serves an important role in clinical forensic medicine including many tasks such as source of interpretation, proofs, medicolegal reports, measurement records, and source which confines the area and dimensions of the wound/injury, matching the patterned injuries with the suspected causative weapon or instrument. These recordings of injuries which might get healed then are represented in the courtroom aiding the examiners, prosecution, and court in decision-making. Documentation of injuries can be done in various formats mainly comprising the handmade notes, pro forma diagrams, keeping the photographs, etc. Nowadays, records in the form of digital images have become the appropriate method for injury documentation which is followed by hand-drawn and handwritten notes, although digital photography is a usual technique for the documentation of injuries [9, 10].

### 9.2.1.3 Types of Injury

The practitioner who is assessing the injury should have a good knowledge and understanding of the terms, factors, and nature of injury describing clearly, using the medical context, injury classification. The classification of injuries which is appropriate and clear and mostly seen injuries has been represented in the following (Table 9.2).

## 9.2.2 Injuries Due to Arson/Burn

### 9.2.2.1 Introduction

Cases of homicides and suicides are on the rise across the globe. Approximately, one million people die because of suicides and homicides, and common methods are blunt and sharp trauma, hanging, strangulation, etc. The most uncommon method among all those practicing homicide and suicide is burns. Acids and hot liquids are most commonly used in our country for suicidal and homicidal purposes. Homicidal burning of young females is the most common in our country but stimulated as accidental incidence via their family members. Most frequent reasons given in history are explosion due to gas leakage, fire caught while in the kitchen, chimney falling on the victim due to explosion, etc., although most of these usual statements given by respondents are not found to be genuine during investigation by the forensic experts [11].

Burn injuries are underrated trauma which may affect anyone, anytime and anywhere. Reasons for such injuries have been listed in Fig. 9.5. The most common reason for burns in our society is accidental burns. Burn injuries have been considered as the most serious injury which makes human life miserable. In India, accidental burns are considered as the second major cause of death after vehicular accidental deaths [12].

**Table 9.2** Types of mostly seen injuries [8]

Types of mostly seen injuries	
Erythema	Hematoma
Petechiae	Wheals
Abrasions (graze, scuff/brush)	Laceration
Stab wound	Bruises
Scratches	Incisions
Chop wounds	Slash
Bite marks	Firearm injury

**Fig. 9.5** Showing the causes of burn injuries





Appropriate treatment of burn injuries depends upon the determination of burn depth. On the basis of depth, burn injuries are classified into first degree, second degree, third degree, and fourth degree. Studies performed on burn injury assessment have found that there is about 50–80% of accuracy in the burn depth assessment at the clinical level. Therefore, there is a need to work more to understand burn tissues, so that detection of burns will be made easy [13].

The major cause behind burn injuries are heat, fire, and hot liquids. And the different physiological and pathophysiological reactions are associated for different causes [14]. Burn injuries have been considered as the most serious injury which makes human life miserable. In India, accidental burns are considered as the second major cause of death after vehicular accidental deaths [12].

### 9.2.2.2 Classification of Burn Injury

Burn injuries are categorized based on its size and depth. On the basis of depth, burn injuries are classified into four degrees as mentioned in Table 9.3 [15]. Each degree represents a certain type of depth of burn injury. These categories are superficial burns, degree 1; superficial partial thickness degree, 2A; deep partial thickness, 2B; full-thickness burns, degree 3; charring, degree 4 [16].

### 9.2.2.3 Burn Changes

In cutaneous injuries, the following three zones are observed:

1. Zone of coagulation
2. Zone of stasis
3. Zone of hyperemia

1. *Zone of coagulation* is identified by the irreversible injured tissues during the time of injury confining the region of necrosis.
2. *Zone of stasis* is recognized as adjoining to the zone of coagulation. In this zone, the area is exposed to a reasonable degree of damage related to vascular escape. As per the wound surroundings, this zone will either continue to exist or result in necrosis.
3. *Zone of hyperemia* is recognized by the increased supply of blood along with healthy tissues with no risk of death [17].

### 9.2.2.4 Burn Assessment

Findings of burn injuries comprise a broad spectrum ranging from local, minute, superficial, to consumption of bone and soft tissues. Both external and internal burn injury findings depend upon temperature exposure and time applied to the body. Also findings of burn injury depend upon the type of heat transmission to the body and some other prevailing circumstances [16].

1. Color assessment—vascularization, pigmentation
2. Metric variables—extent, height, volume

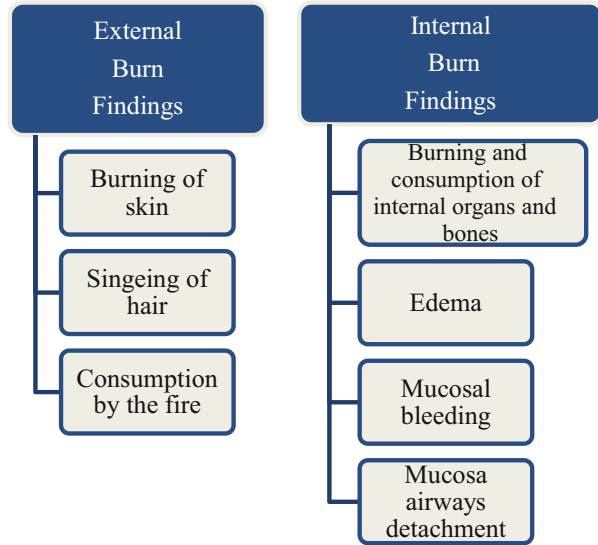
**Table 9.3** Categories of burn injury based on depth [15]

Categories	First degree	Second degree 2A	Second degree 2B	Third degree	Fourth degree
Depth	Superficial	Superficial with partial thickness	Deep with partial thickness	Full thickness	Full thickness
Histology	Only the epidermis is affected	Both epidermis and papillary dermis are affected Skin appendages intact	Epidermis and reticular dermis Most of the skin cells are damaged	Epidermis and dermis All of skin appendages are damaged	Comprises the fascia and muscles and bone
Appearance	Erythema, blanching on pressure, no blisters initially	Blisters, moist red, blanches with pressure, erythema	Red, shiny, severe pain, blisters, wet, doesn't blanch with pressure	Dry, waxy white, moist, leathery skin	Dry, black, charred
Treatment	Not serious unless more or larger areas are involved; cleaning and cold compress	Cleaning and cold compress, disinfected dressing	Hospitalization is needed if 25% surface area affected; surgery or grafting	Immediate hospitalization	Surgical interference and grafting are required for the healing
Risk factors	Risk of skin cancer	Local infection	Skin grafting	Amputation, risk of developing hypertrophic scars	Gangrene, amputation, demise
Scarring	Nothing	Pigmentary changes	Severe	Very severe; hard and elastic eschar tissue	Hard and elastic eschar tissue
Healing period	3–6 days	7–20 days	>21 days	Never heals	Never heals
Pain condition	Painful	Painful	Sensitive of pressure	Deep pressure	Deep pressure

3. Biomechanical properties—elasticity, stiffness

4. Physiologic changes—hydration (Fig. 9.6)

**Fig. 9.6** External and internal findings of burn injury [16]



### 9.2.2.5 Burn Assessment Techniques

For the clinical assessment of burn injuries and their depth, the following techniques have been established [13]:

1. Biopsy and histology
2. Laser Doppler
3. Thermography
4. Vital dyes
5. Video microscopy
6. Orthogonal polarization spectral imaging (OPSI)
7. Reflectance confocal microscopy (RCM)
8. Multispectral imaging (MSI)
9. Optical coherence tomography (OCT)
10. Near infrared spectroscopy (NIRS)
11. Terahertz imaging
12. Ultrasound
13. Laser speckle imaging (LSI)
14. Spatial frequency domain imaging (SFDI)
15. Photoacoustic imaging

1. **Biopsy and histology**—this is often referred as the “gold standard” in assessment of burn depth which gives reference for the rest of the techniques. In this approach, tissue is first removed and then introduced into a reagent like formalin to avoid damage. The tissue is then cleaned, dried out, infiltrated, and cut into thin sections of size  $\sim 50$  nm– $4$   $\mu$ m based on the choice of microscope to be used. Later, the tissue is stained, placed under microscope and assessed. As biopsy and

histology is an excellent approach for analyzing burns, there is also requirement of more noninvasive approaches to be introduced for clinical purposes.

2. **Laser Doppler techniques**—there are two type of laser Doppler technique: one is laser Doppler flowmetry, and the other is laser Doppler imaging working on the same principle.

- (a) **Laser Doppler flowmetry**—this approach is the oldest of Doppler techniques assessing the microcirculation in burn injury with a direct contact giving high-accuracy burn depth results. Due to its direct contact with the injury, the use of this technique is limited which may spread the infection and lead to discomfort of patients.

- (b) **Laser Doppler Imaging**—this approach is more advanced and latest which provides non-contact scanning facility and can measure burn depth and the entire burn surface. LDI is the only approach for burn depth assessment which has been endorsed by the American Food and Drug Administration (FDA).

This approach provides high accuracy and high efficiency. But accuracy is challenged when there is an extreme movement of patients. Along with it, LDI is quite expensive and demands long time for setup before clinical assessment.

3. **Thermography**—there are two types of thermography, i.e., active and static thermography.

- (a) **Active dynamic thermography**—temperature response is evaluated through thermal pulse excitation.

- (b) **Static thermography**—in this type of thermography, temperature is determined though the temperature difference between the burn affected area and unaffected area.

As thermography is a quick and affordable approach, accuracy is challenged in some circumstances when granulation begins in burn wounds. Therefore, thermography is recommended to use within 3 days post burn for best possible outcomes.

4. **Vital dyes**—fluorescent and non-fluorescent dyes are introduced intravenously followed by optimal illumination sources to make the microvascular structure observable. ICG which is a fluorescent dye is considered as a nontoxic dye. ICG video angiography is associated with biopsy % histology, and the clinical results of this particular approach are nearly 100%. But this approach is cost-effective, and there are some side effects also associated with it such as headache, diaphoresis, urticaria, etc. ICG video angiography is capable enough to identify the burn depth few hours post burn.

5. **Video microscopy**—this technique utilizes the transcutaneous microscopy along with fiber-optic light source to make the dermal papillary structure visible on the burnt surface and capable assessment of burn depth based on the integrity of structure visualized. This approach has advantages as it is quite simple and easy to operate when assessing burn depth within the 24 h post burn, while laser Doppler imaging takes 48 h. The disadvantage associated with video microscopy is that it also requires direct contact with wound which may spread infection, alleys discomfort among patients, and caters assessment only of a small burn area.

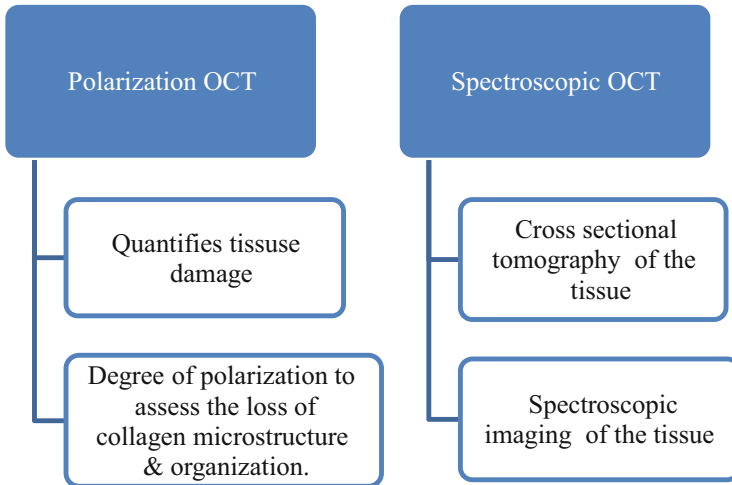
6. **Orthogonal polarization spectral imaging (OPSI)**—is a type of transcutaneous video microscopy which gives real-time imaging of capillary network via cross-polarization phenomenon. This approach provides good-resolution microvascular structure. There are disadvantages associated with OPSI, i.e., needs direct contact with wound which leads to discomfort and risk of infection and also time-consuming as it takes a long time while scanning the burn area.
7. **Reflectance confocal microscopy (RCM)**—this approach “optical biopsy” as the term indicating capable to study the tissue without physically dissecting with the help of a laser emitted from a source and skin contact device focused on the tissue and gathering the reflection via detector. There are many demerits of RCM. Firstly, it involves skin contact which raises infection risk and discomfort among patients. Time taken for sampling is quite long, and the technique is cost-effective. Also, there are no details available on the burn depth accuracy of RCM.
8. **Multispectral imaging**—this technique is noninvasive and demands no skin contact based on the principle of optical properties such as reflection, absorption, scattering, etc.  
The application of this approach is observed to have the capability to act as a clinical tool.
9. **Optical coherence tomography**—there are two kinds of OCT, i.e., polarization-sensitive OCT and spectroscopic OCT.
10. **Near infrared spectroscopy (NIRS)**—NIRS has the capability to distinguish between burn depths and alteration deeper into the skin. The accuracy of NIRS for clinical application of assessing burn depths is not reported yet.
11. **Terahertz imaging**—THZ imaging is used as burn assessment in both in vivo and ex vivo conditions. This particular approach has the capability to assess burn depth but lack the standardization of burn depth quantification. The accuracy of THZ imaging still needs to be reported.
12. **Ultrasound**—this technique is widely used in clinical applications. These approaches still need to be observed for burn assessment and also in combination with other methods like elastography to analyze tissue elasticity.
13. **Laser speckle imaging (LSI)**—LSI is capable of providing high-resolution images and is getting attention in recent years for burn assessment. This technique have shown advantages and satisfactory results over the laser Doppler imaging, and this LSI further needs more development for burn wound assessment.
14. **Spatial frequency domain imaging (SFDI)**—this is a wide-field optical and non-contact approach capable of assessing the tissue about 1–5 mm below the surface of the skin. SFDI is a recent, influential approach for scrutinizing the variation in burnt tissue properties. This approach has the potential for enumerating burn depth in the beginning stages, and its accuracy still needs to be reported [13] (Figs. 9.7 and 9.8).

### 9.2.2.6 Pain Management in Burnt Patients

It is critical to manage the pain in the rigorously burn patients or victims. In the early stage, during emergency, potent opioids are given intravenously to patients as per

Fluorescent Dyes	Non Fluorescent Dyes
<ul style="list-style-type: none"> <li>• Sodium Fluorescein</li> <li>• Indocyanine Green (ICG)</li> </ul>	<ul style="list-style-type: none"> <li>• Evans Blue</li> <li>• Patent Blue V</li> <li>• Bromophneol Blue</li> </ul>

**Fig. 9.7** Showing the types of vital dyes used



**Fig. 9.8** Types of optical coherence tomography

their response such as fentanyl, morphine sulfate, hydromorphone, etc. For minor pain, acetaminophen is given. For moderate pain, an oral oxycodone or acetaminophen mixture is given. Those who are resistant to opioids, ketamine (0.1–0.2 mg/kg) can be given to them. Along with this, antidepressants, anti-anxiety, and anticonvulsants have been found effective in burn patients or victims [18].

### 9.2.2.7 Self-Inflicted Burn

Self-inflicted burns show a significant social and medical issue for society. Contrasts have been shown between patients who endeavor suicide and individuals who intentionally hurt themselves with no intention of committing suicide. These self-perpetrated injuries may take after wounds that are purposefully delivered by others and may require examination by defensive administrations. There is less information available on specific burn pattern injuries in psychiatric patients. There are rare cases of self-inflicted burn patterns. The factors responsible for the suicidal attempts might include loneliness, separation, hopelessness, stress, depression, or any associated mental health disorder. In self-inflicted suicidal burn attempts, accelerants have been used. The patients who are mutilating themselves have a pre-existing psychiatric

disorder. There is another term, i.e., para-suicidal behavior, which means intentionally causing self-injury which is not fatal but may raise the risk of tissue damage and death. Larger and deeper injuries are reported in patients who attempt suicide by burning. Studies have reported higher mortality rate for those patients who have previous record of suicidal attempts or self-harming. The management of such patients should involve the treatment of burn injury, psychological assessment, and regular monitoring by mental health experts [19].

### **9.2.3 Sexual Assault**

#### **9.2.3.1 Introduction**

The cases of sexual assault are accruing in this new era. Sexual assault is a crime in which the assailant harms the modesty of a victim or touches the victim in sexual manner, and these activities occur without the victim's consent. Generally, the victim is forced to make sexual contact [20]. This activity is illegal in front of law. A man or a woman is said to commit sexual assault if he or she sexually touches a person or forces someone to make sexual contact with him or her in conditions like:

- Without his/her consent.
- With consent but the person is not capable of giving consent, e.g., intoxication or mental trauma, etc.

#### **9.2.3.2 Examination of the Victim**

1. The time, date, and location of assault should be noted.
2. The number of times the victim was assaulted should be noted.
3. The victim's statement and other people's statement who were associated with crime should be recorded by separating each one of them.
4. The victim should be asked for any kind of toxic agents like alcohol and drugs involved in the crime with all the details.
5. The victim should be looked for any kind of physical injuries.
6. All the chemical, physical, or biological evidences should be collected from the victim as well as from the scene of the crime.
7. All trace evidences should also be collected like hairs, mud, glass, buttons, etc.
8. The victim should be examined by a medical practitioner with the consent of victim. All injuries like nail scratches or other physical injuries should be recorded with proper proof like photographs for further use.
9. The victim's examination should be done in the presence of a third person. A female nurse is preferred for it; otherwise, any female relative of the victim can be present at the time of examination.
10. Proper treatment of injuries should be given to the victim after examination [21].

#### **9.2.3.3 Examination of the Suspect**

1. The suspect should be examined for any kind of physical injuries made by the victim in defense.

2. All the clothing of the suspect should be collected at the time of examination and looked out for DNA evidences.
3. The concerned body parts reported by the victim should be focused more, and all the possible evidences should be collected, e.g., if the victim was forced for oral sex, then the suspect's genitals will provide better evidence than the mouth of the victim.
4. All body injuries should be recorded with photographs [22].

### 9.2.4 Sexual Offences

Sexual offences are classified into two categories according to the manner of crime as follows:

- Natural sexual offences
  1. Rape
  2. Incest
- Unnatural sexual offences
  1. Sodomy
  2. Bestiality
  3. Tribadism
  4. Buccal coitus
- Sexual paraphilias
  1. Necrophilia
  2. Necrophagia
  3. Sadism
  4. Masochism
  5. Fetichism
  6. Frotteurism
  7. Undinism
  8. Transvestism
  9. Exhibitionism (Fig. 9.9)

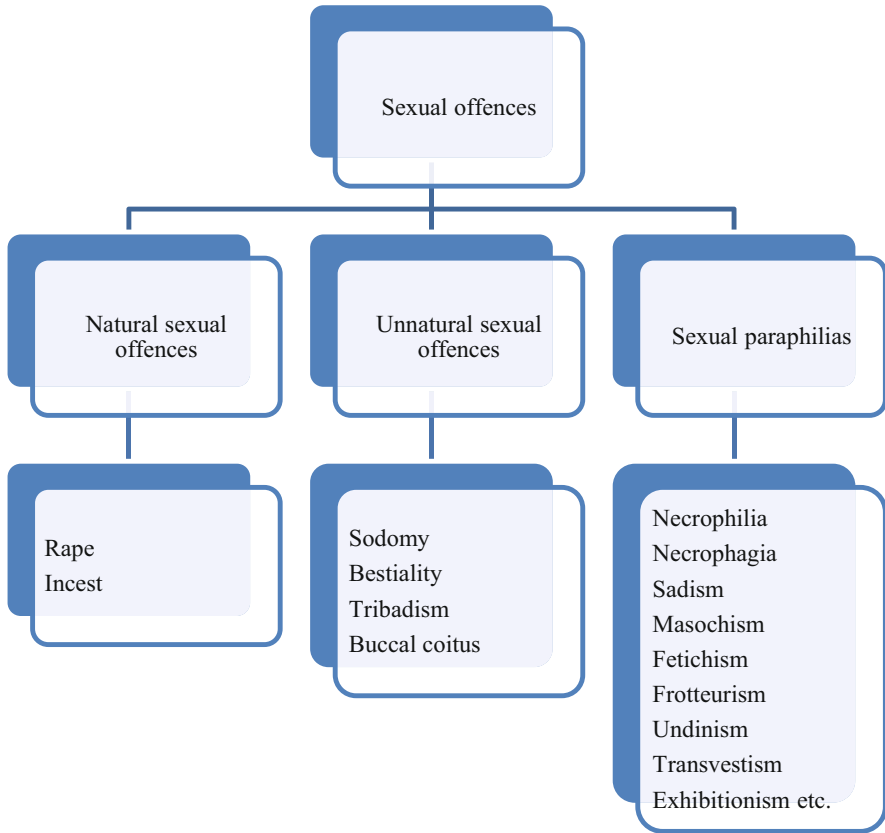
#### 9.2.4.1 Natural Sexual Offences

##### Rape

Rape is a serious crime which is increasing day by day [23]. This crime is not only happening with females, but the male population is also becoming a victim of it. A male is alleged to commit rape if he does any of these four things with a woman:

- (a) If he penetrates his penis up to any extent, in the vagina, anus, urethra, or mouth of a female, or forces her to do the same thing with him or someone else.
- (b) If he introduces any object or any body part excluding the penis up to any extent inside the vagina, anus, or urethra of a female or forces her to do the same thing with him or someone else.





**Fig. 9.9** Classification of sexual offences

- (c) If he manipulates a woman’s body parts to cause any kind of penetration in the vagina, anus, or urethra or any other body part or forces her to do the same thing with him or someone else.
- (d) If he puts his mouth on a woman’s vagina, anus, or urethra or forces her to do the same thing with him or someone else.

These are the seven circumstances which constitute above conditions of rape:

1. Without her will.
2. Beside her consent.
3. With her consent, but the consent was taken by putting her or someone close to her in threat.
4. By making false belief that they two are lawfully married.
5. With her consent, but the consent was taken when she was in the condition of unsound mind or intoxication.

6. When her age is less than 18 years, her consent is not valid.
7. When she is not able to communicate her consent [24].

### **Examination of the Victim**

1. Firstly the consent for medical examination should be taken from the victim.
2. The examination should be done in front of a female family member or a nurse.
3. The victim needs to be examined only after requisition from the Magistrate or Investigating officer.
4. All information like name, age, gender, parents' name, and date and time of incident should be recorded.
5. The victim should be asked for her last consented sexual intercourse, and time interval from the incident should be recorded.
6. All the information about offence should be asked and recorded like exact relative position and number of assailant, number of sexual act, any drug or alcohol used, details about resistance and struggle, any weapon used, etc.
7. The examination should be done without any delay.
8. The victim should be asked if she took a bath or washed her genitals after rape.
9. The victim needs to be undressed completely, and examination should be done with the help of ultraviolet light for semen stain detection.
10. All injuries need to be recorded at the time of examination. The genitals and thighs should be checked properly for injuries [25].
11. Close-up photographs of injuries should be taken for record purposes.
12. The genitals should be checked for semen, and swabs should be taken for spermatozoa identification.
13. Clothes of the victim should be looked after for seminal or blood stains. Clothes can corroborate her story correctly. Undergarments should be examined properly as there can be semen stains due to drainage from the vagina.
14. The pubic hairs of the victim should be combed to collect foreign hairs. And 20–50 hairs should be plucked out from the victim's pubic area.
15. Nails of the victim should also be collected by cutting them as there can be skin tissues of assailant in nails due to scratching during struggle [26].

### **Examination of Suspect**

1. The suspect examination is much similar to victim's examination. The suspect should be inspected for all the harms which the victim said that she has inflicted.
2. The consent of suspect should be taken, and he must be informed that the report will be submitted to police and courts, and it can be against him.
3. All information like name, age, gender, and personal identification marks should be recorded by investigating officer.
4. The examination of the suspect should be conducted as soon as possible as the marks of act may vanish after sometime.
5. Information like last consenting intercourse, last bath, last changing of clothes, etc. should be recorded.
6. His state of mind and general behavior should be observed and recorded.
7. It should be recorded if he seems under the influence of drugs or alcohol.

8. All the physical injuries should be noted including genital injuries; there can be bruises, abrasions, scratches, etc. Reddening of glans and patchy structure is more common.
9. The suspect's penis should be washed with saline, and the solution should be stained with Papanicolaou's stain.
10. The suspect's penis should be cleaned with filter paper, and the filter paper should be exposed to Lugol's iodine fumes. The filter paper will become brown if vaginal epithelial cells are present as they contain glycogen.
11. Specimens like swabs from the penis for infecting organism and blood, etc., blood samples, pubic hairs, head hairs, any loose hair found on body, and nail scrapings should be collected and preserved [27].

### **Incest**

A sexual intercourse is called as incest when both the male and female are closely related to each other (e.g., sister, mother, granddaughter, stepdaughter, etc.). These are the cases which usually have psychological features [28].

### **9.2.4.2 Unnatural Sexual Offences**

#### **Sodomy**

It is a sexual intercourse, when the male introduces his penis inside the anus of a male or a female. Sodomy was used to be practiced in Sodom town. Sodomy is also known as buggery [29].

#### **Bestiality**

When a human being performs sexual act with a lower animal, this sexual intercourse is known as bestiality. This includes animals such as dog, cat, cows, etc. [30].

#### **Tribadism**

When a female obtains sexual gratification by kissing, body contact, manipulation of genitals or breast, or rubbing external genital organs of another female, it is called tribadism [31].

#### **Buccal Coitus**

When the penis of a male is introduced inside the mouth of another male or female, it is called buccal coitus. This act was common in Gomorrah town according to the Bible. In this act, death may occur due to aspiration of semen in the hypopharynx [32].

### **9.2.4.3 Sexual Paraphilias**

#### **Necrophilia**

This offence includes sexual intercourse with a dead body. In this condition, the desire of sexual intercourse with a dead body is there. This behavior is

sadomasochistic, and foul smell of decomposition and coldness act as stimulating agents, whereas murder for purpose of necrophilia is exceptional [33].

### **Necrophagia**

When someone obtains sexual pleasure by sucking or licking wound, eating flesh, biting skin, or drinking blood of a dead body, that condition is called necrophagia. This act is an extreme degree of sadism [34].

### **Sadism**

Sadism is active algolagnia in which algos means pain and lognia means lust or craving. When sexual gratification is obtained by infliction of pain or physical cruelty upon one's partner, it is called sadism [35].

### **Masochism**

Masochism is completely opposite to sadism. In masochism, the suffering of pain leads to obtaining sexual pleasure. Masochism is passive algolagnia. People who are masochistic gets pleasure by being humiliated, tortured, abused, beaten, and enslaved by their partner. In a sadomasochistic relationship, one person is dominant over the other being sadistic [36].

### **Fetichism**

When the person obtains sexual gratification by abnormal stimulus or objects, called as fetichism. Those objects or abnormal stimulus which are used to get sexual gratification are called fetish. Those objects can be anything which have sexual influence like underclothing, shoes, petticoat, etc. In this, the person obtains excitement leading to orgasm [37].

### **Frotteurism**

Frotteurism is obtaining gratification sexually by rubbing his private parts on the female's body parts like the breast, buttocks, thighs, etc. in crowded places. People who are frotteuristic think that the victim will not be offended by being touched but instead will get pleasure [38].

### **Undinism**

In undinism, to obtain sexual gratification, someone watches someone else urinating, either of the same sex or opposite sex. There are also some cases in which one gets sexual pleasure by being urinated upon by loved ones [39].

### **Transvestism**

It is also called eonism. When the whole personality of a person is controlled by the desire of being recognized as member of the opposite sex, this condition is called transvestism. It is generally seen in males who use to obtain sexual gratification by wearing female dresses [40].

### Exhibitionism

Some people expose their genitals to children or members of the opposite sex to fulfil their fantasies and obtain gratification sexually; this act is known as exhibitionism. This is generally practiced by males who expose their genitals to get attention and feel arousal [41].

## 9.2.5 Child Abuse

### 9.2.5.1 Introduction

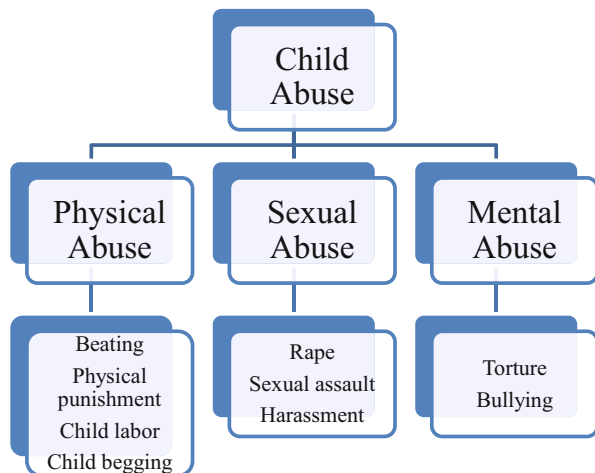
Child abuse is defined as any harm to children by an adult either physically, mentally, or sexually. Child abuse is a social issue and is happening in the daily life of children. Some of them are aware of that and some are not. There are different kinds of abuse that are tolerated by children worldwide, and in most of the conditions, children are sometimes not capable of understanding the assault and sometimes not capable of complaining about what they are going through [42].

### 9.2.5.2 Types of Child Abuse

There are different types of child abuse:

- Physical abuse like beating, physical punishment, child labor, and child begging
  - Mental abuse like torture and bullying
  - Sexual abuse like rape, sexual assault, and harassment (Fig. 9.10)
1. **Physical abuse:** Physical abuse happens when physical injury is inflicted upon the child in different forms. Sometimes, the child is abused by their parents for labor; this mainly happens in cases of poor families. In some cases, the child is exposed to forced begging which is another form of physical abuse. Beating a child and physical punishment are also physical abuse [43].

Fig. 9.10 Classification of child abuse



2. **Sexual abuse:** Sexual abuse happens when the child is used for sexual stimulation. There are so many cases of child rapes, sexual assaults, and harassment. It mainly happens because the child is not capable of rejecting or complaining about it.
3. **Mental abuse:** Mental or psychological abuse happens when a child is constantly tortured or bullied by someone. It is a form of abuse that is very hard to identify and has a very bad impact on the mental health of the child which in later life turns into a psychological problem for life.

### **9.2.5.3 Examination of Victims in Child Abuse**

It is very hard to identify the victim in cases of child abuse. There are a few signs and symptoms we can look for [44]:

#### **In Physical Abuse**

- Cigarette burns may be present.
- Bruises.
- Fracture.
- Permanent damage to some parts of the body.
- Other body injuries.

#### **In Sexual Abuse**

- Physical examination
- Bruises around genitals
- Signs of rape
- Signs of force
- Bite marks

#### **In Mental Abuse**

- Fearful
- Hate toward parents
- Emotionally weak
- Difficulty in speech

### **9.2.5.4 Examination of Suspects in Child Sexual Abuse**

In sexual abuse, the examination of suspects is done by a medical examiner for any type of sexual intercourse, and other samples are collected for forensic examination, which help prove the crime [45]. Samples that are collected for forensic examination are:

- Suspect's and victim's clothing
- Swabs
- Pubic hairs
- Nails scrapings
- Other materials like bed sheets, condoms, etc.

## 9.2.6 School Violence

### 9.2.6.1 Introduction

School violence is considered a serious issue across the world and more problematic when there is involvement of weapons. The term “school violence” is defined as a violent activity inside the school which involves bullying, physical as well as verbal abuse, harassment, physical violence, shooting, etc. between the students and also often towards the school staff members. The most commonly observed issues with the school violence are bullying and physical abuse [46].

### 9.2.6.2 Cause and Factors Responsible for School Violence

1. Family environment—exposure to violence over a longer period within the family, domestic violence, parental alcoholism.
2. Child abuse—physical and sexual abuse during childhood.
3. Physical punishment—leading to aggressiveness.
4. TV and video games—may act as triggers.
5. Neighborhood—surrounding environment with drug abuse and criminals is also linked with violent behavior of youths and children.
6. Poverty.
7. Lower academic performance.

### 9.2.6.3 Behavioral Distinction

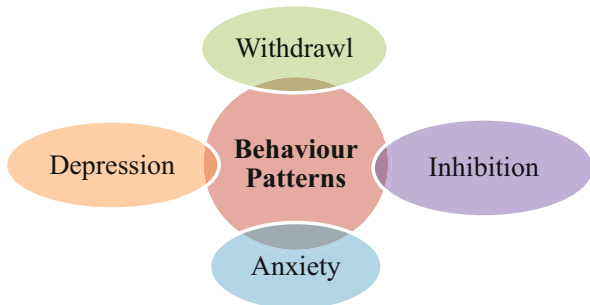
The behavioral patterns associated with violence in school or among the youths have been represented in Figs. 9.11 and 9.12.

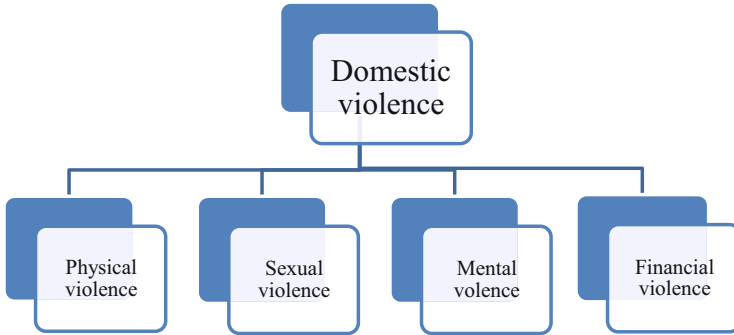
### 9.2.6.4 Preventive Measures of School Violence

The prevention of school violence should be done at four levels including:

1. **Family environment**—establishing a healthy environment at home
2. **Society**—reshaping the social norms and educational structures
3. **School community**—re-establishment or amendment in school characteristics, classroom management, supportive learning, and close supervision

**Fig. 9.11** Showing the behavioral pattern associated with school/youth violence





**Fig. 9.12** Classification of domestic violence

4. **Individual level**—empathy, impulse control, reducing the level of physical aggressiveness and bullying in a modified curriculum with supporting strategies
5. **Anti-violence program** [46]

## 9.2.7 Domestic Violence

### 9.2.7.1 Introduction

Domestic violence is any abuse between partners living in the same place. Domestic violence includes physical, sexual, mental, financial, or any abuse either by a male on the female partner or by a female on the male partner. But in most of the time, the term domestic violence is used for male abuse upon their female partner; it may include any type of abuse [47].

### 9.2.7.2 Types of Domestic Violence

- Physical violence
  - Sexual violence
  - Mental violence
  - Financial violence
1. **Physical violence:** In most cases, physical violence is done over the female partner. It includes physical assault, killing their partner, or grievous hurt to the partner. It is the most common type of domestic violence and happens in small, poor, uneducated families.
  2. **Sexual violence:** Sexual violence is forcing own partner for sexual intercourse. Sexual violence includes marital rapes, unnatural sex, etc. This type of violence is not reported most of the time because of fear of losing a partner and financial support [48].
  3. **Mental violence:** Mental or emotional violence is a type of violence in which one partner restricts doing normal things and resort to blaming or accusing the partner. It may include things like preventing from using the phone, using abusive words, etc.



4. **Financial violence:** Financial violence happens when one partner is dependent on others financially, and the victim is not getting enough resources and doesn't have access to money or credit cards.

It also includes demanding dowry from the partner.

### 9.2.7.3 Examination of Victims in Domestic Violence

Domestic violence victims mainly suffer from physical assault and abuse. The signs and symptoms we can look for are as follows [49]:

- Physical injuries
- Fractures
- Signs of assault
- Weakness
- Ill
- Psychological problems

### 9.2.7.4 Examination of Suspects in Domestic Violence

In domestic violence, the suspects are mainly one of the partners and maybe their family members.

In cases of sexual violence, the suspects are examined for any rape and unnatural intercourse; it is mainly done by medical examination and forensic examination [50].

In death-related cases, medical and forensic examination is done to examine the suspects.

## 9.2.8 Pseudo Victimization

There are many cases reported in recent years in which people harm themselves to put allegations on others. The cause of pseudo victimization can be revenge, jealousy, financial gain, or to harm someone's modesty. Pseudo-victimization cases are generally seen in assault cases, either through sexual assault or physical assault like false rape charges. Some plant products are being used like *Semecarpus anacardium* and *Calotropis gigantea* in these kinds of activities [24].

There are some chemicals also which are being used to produce artificial bruises on the body; however artificial and real bruises can be examined and can give accurate results. It can be a psychological disorder also as there is history of repetitive attempts by people. The numbers of cases of false charges are increasing due to interlink between the law and psychology. For example, there are strict rules for domestic violence in India, and the victim needs not to prove that, but the burden of proof lies upon the suspect, and this makes some psychologically ill people put false charges against in-laws. Other examples are false rape charges and general assault cases.

## 9.2.9 Self-Harm

### 9.2.9.1 Introduction

[Synonyms – “Self-mutilation,” “Self-inflicted injury,” “Self-injurious behavior”]

Self-harm reflects an extreme human behavior which defines the disturbance produced due to someone’s personal or individual physical integrity and health without any suicidal intentions. Attempts such as biting and tearing out nails, pulling the hair, and making huge demands are outcomes of stress, diseases, or personal or financial needs [51].

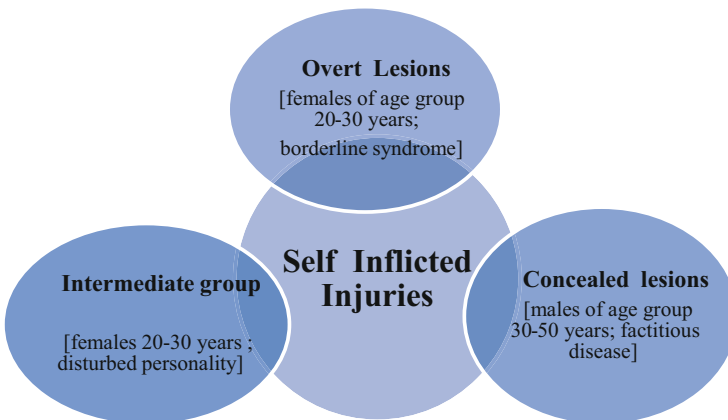
### 9.2.9.2 Characteristics of Self-Harm

1. Mostly observed as cuts and scratches
2. Symmetrical, uniform, and same depth
3. Usually not severe
4. No defense wound/injuries
5. No damage to clothing
6. No injury on pain-sensitive areas

### 9.2.9.3 Categories of Self-Harm (Fig. 9.13, Table 9.4)

#### 9.2.9.4 Diagnosis of Self-Harm

1. **Whole body examination**—whole body examination is included in the forensic medical physical examination.
2. **Documentation**—documentation of injuries to be done in detail; exact description as possible.
3. **Diagnostic differentiation**—lesion count and types, severity, intensity, structure, size, shape, etc. [51].



**Fig. 9.13** Categories of people showing self-inflicted injuries based on psychological criteria

**Table 9.4** Categories of self-harm

General relevance with clinical forensic medicine	More—relevance with clinical forensic medicine
Heredity	Simulation
Ornamental scars/self-injuries	Penitentiary system
Body modification/bod-mod	Military service
Psychological disorders	Insurance fraud
Genital self injuries	Fake criminal offences
Self-burning	Personality disorders

### 9.3 Conclusion

Forensic pathology, clinical medicine, and forensic pathology such terms are utilized across the world. Clinical forensic medicine is also a branch of medicine which involves living individuals and working together with law, judiciary, and police personnel. In the more extensive sense, clinical forensic medicine implies the use of clinical information and abilities to living people relating to the uncommon necessities of the particular legitimate, legal, and police frameworks. It is significantly important that forensic physicians should be trained, experienced, and qualified. There are several ways of accreditation of forensic physicians. But in some countries, there is not any accreditation system found. There must be introductory training programs for beginners under a qualified supervisor, setting up the standards of quality and service, professional development, etc. When acting as expert witness, they are supposed to present the reports in an adequate and accurate manner without adding any information intentionally which might be harmful for patients; otherwise, they can be charged for their negligence. Trauma and violence both are found as a serious issue to health throughout the globe. New emerging tools and techniques and advancements in the classification and assessment of burn injury and wounds may provide an opportunity for the treatment of burn patients more accurately. The techniques further need more practices and work for clinical applications and accuracy to be tested. The cases of sexual assault are accruing in this new era. Cases of sexual assaults are increasing day by day which are not only happening with females, but the male population is also becoming a victim of it. There are different kinds of abuse that are tolerated by children worldwide, and in most of the conditions, children are sometimes not capable of understanding the assault and sometimes not capable of complaining about what they are going through. There are also many cases reported in recent years in which people harm themselves to put allegations on others. The cause of pseudo victimization can be revenge, jealousy, financial gain, or to harm someone's modesty. Pseudo-victimization cases are generally seen in assault cases, either sexual assault or physical assault like false rape charges. Clinical forensic medicine signifies a new era of medical practice. The new role of forensic experts has been identified as applying the principles, knowledge, and standards in injuries assessment, trauma care, extreme human behavior,

violence, child abuse and its related offences, sexual offences, pseudo victimization or self-inflicted injury, etc.

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