Determining an Attacker's Height from Angle of Stab Wound

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Abstract

In this experiment, the angle of the knife in a stab wound was analyzed to determine if it correlated with the height of the attacker. The height of the victim was constant for all heights, 155, 165, 177, 187 centimeters, and respective trials. The wound was simulated by stabbing florist's foam, used in place of flesh, three times at each height. After comparing the angle results with the height, it was found that the height increased along with the bottom angle of the knife. The direct correlation between the height of the attacker and the angle of the knife supported the hypothesis.

Keywords: trauma, stabbing, wound, angle, height

In 2016, 1,604 homicide victims were killed with knives or other sharp instruments in the United States (Federal Bureau of Investigation 2016). Within this experiment, the angle of the stab wound was compared to the height of the attacker. In previous homicide or assault cases, eyewitnesses frequently described the height of an attacker during testimony; the results of this experiment could corroborate or contradict these claims (Wagstaff 2003). The angle of a stab wound could also be used to differentiate between a suicide and a homicide, as almost 3% of all suicides were the result of stabbing (Venara 2013). Penetrating wound angles have been researched extensively for studies utilizing laparoscopy, in which a very small surgical incision was made in the abdomen and a camera was pushed down into the incision (Uyama 2001). Outside of those studies, a very minimal amount of research has been conducted regarding stab wound angle.

Materials and Methods

The victim was created using a PVC pipe, which went through the 30.0 cm by 46.0 cm block of florist foam, sticking out of a concrete base. The base was 61.0 centimeters from the researcher's back heel and 46.0 centimeters from the tip of the front foot. The overall height of the victim

structure was 167 centimeters; a line was drawn across the foam at the 127-centimeter mark to represent an approximate placement of the victim's heart. The heart was chosen because one of the most prevalent sites of stab wounds is the chest (Swann 1985). The 40-centimeter difference was approximated by the 20 centimeters from the top of the head to the bottom of the chin. The last measurement was roughly 10 centimeters from the chin to the jugular notch and the approximate 10 centimeters from the jugular notch until the center of the heart (George 2017).

A 9-centimeter straight edge paring knife was stabbed into the line at three different spots per height using a downward stabbing motion. The angle of the arm upon impact was 100º. The different heights of attackers were 155, 165, 177, and 187 centimeters. The researcher was 177 centimeters tall; therefore, the other heights were mimicked by crouching and the use of a stool. With every height variation, the force used by the researcher remained constant. Once the knife was embedded, a small wooden dowel was placed against the knife and thrust into the foam, keeping the same angle. A protractor was used to measure the bottom angle. This procedure was repeated for all trials within each height variation.

Results

The results of the height of 155 centimeters, in Table 1, varied for each trial; there was a range of 5.00º for this height. The average of the three angles was 122.3º, while the standard deviation was 2.055º. In Table 2, the 165-centimeter height, had one repeated angle, 128.0º, for trials 1 and 3. The range was 2.00º, the average was 128.7º, and the standard deviation was 1.155º. The third height of 177 centimeters, in Table 3, also had a repeated result; trials 1 and 3 had angles of 140.0º. Yet again, the range was 5.00º. The average angle was 138.3º, and the standard deviation of the trials was 2.887º. For the height in Table 4, 187 centimeters, the range was 5.00º, with 149.7 º as the average angle and 2.517º as the standard deviation. The degree difference between the highest average, 149.7 º, and the lowest average, 122.3º, was 27.4º.

Table 1. The knife angles at 155 centimeters

Height: 155 cm	
Trial #	Angle
1	120.0 º
2	125.0 º
3	122.0 º

Table 2. The knife angles from 165 centimeters

Height: 165 cm	
Trial #	Angle
1	128.0 º
2	130.0 º
3	128.0 º

Table 3. The knife angles from 177 centimeters

Height: 177 cm	
Trial #	Angle
1	140.0 º
2	135.0 º
3	140.0 º

Table 4. The knife angles from 187 centimeters

Height: 187 cm	
Trial #	Angle
1	147.0 °
2	150.0 °
3	152.0 °

Discussion

The averages of the angles increased as the height increased. Since the bottom angle of the knife was observed, the height of the attacker and the knife wound angle had a positive correlation. If the top angle were to be measured, there would have been a negative correlation; the angles would have decreased as the height increased. The difference in height between the victim and the attacker determined the degrees of the knife angle. Since the victim was stabbed at the same height each trial, the attacker subsequently stabbed at an angle that was agreeable to their height and arm length. In order for the tallest attacker to stab at the same angle as the shortest, their wrist would have to twist in an uncomfortable way because the radial deviation angle of the wrist tends to be lower than the ulnar deviation angle (Gheno 2009). The use of an overhand stabbing motion required radial deviation. In order for the assailant to not injure themselves, they combatted the increased radial deviation angle with the increased knife wound angle to stab in the same place.

This research can be applied to homicide or assault investigations, especially regarding those that have eyewitnesses. If the eyewitness recounted that the assailant was taller than the victim and used overhand stabbing motions, the knife wound could be examined to either corroborate or contradict the statement. Without an eyewitness, the knife wound analysis could still be used to approximate the height of an assailant. Knowledge of the height of an attacker could prove instrumental in crime scene reconstruction; it could help determine the relative position of the assailant.

The use of the angle as evidence could be rendered obsolete if the knife wound was “superficial”, meaning it was parallel with no or minimal angle (Ohshima 2005). Results from the knife wound analysis could also be distorted if there was a large concentration of stab wounds in one area (Hunt 1991). The stab wound angle was not determined to be individualizing. The angle would be considered class evidence, meaning that suspects could only be excluded (Cole 2009). More research would have to be conducted in order to decide whether or not the angle-height correlation was reliable. Further research could be done using ballistics gel instead of florist foam to simulate flesh; more trials would also have to be conducted. Using ballistics gel would require a greater amount of force than the florist foam; the increased amount of force should not affect the results of the experiment (Green 1978). If a large enough number of trials were conducted, a distinct quantitative correlation may be determined.

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