

## Case Report

# An Autopsy Report Case of Rape Victim by the Application of PSA Test Kit as a New Innovation for Sexual Assault Investigation in Thailand

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*The case of a 30 year-old Thai female found dead on the floor at the base of a small monument on Rajadumnern Road, Bangkok, Thailand with blood stains around the body and a naked bottom. The scene investigation and autopsy findings suggested a sexual assault and multiple sharp force injuries. The approach to the postmortem examination using different laboratory tests is reviewed. The specificity and sensitivity of prostate specific antigen (PSA) in specimens from rape victims is better than acid phosphatase test. The ELISA test for PSA was tested to confirm the PSA test kit. The present report suggests the PSA test kit in addition to conventional sperm smear and acid phosphatase test for sexual assault investigation in Thailand.*

**Keywords:** PSA, PSA test kit, ELISA for PSA, Acid phosphatase, Sperm, Rape

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Sexual assault is usually an un-witnessed crime. Therefore, forensic investigation and identification of the spermatozoa and semen on the specimen collected from the vagina of female victims plays an extremely important role in the court testimony to confirm the recent episode of sexual intercourse.

In fact, microscopic visualization of the spermatozoa is a gold standard method to prove that the female victims had recently been violated. However, if the male offender is a vasectomized or an azoospermic individual, it is impossible to prove the recent sexual event by identification of the spermatozoa and this may let the offender go free. In the US, the reported frequency of azoospermia is 1% to 9% in seminal-stains or swabs-examined sexual assault cases and the frequency of contraceptive vasectomy has been estimated to be 750,000 to 1,000,000 per year<sup>(1,2)</sup>.

In recent years, the acid phosphatase test was generally used as a routine test for identification of the semen in stains or swabs. However, according to scientific results, acid phosphatase test is only a

presumptive test or a screening test and it is rapidly degraded in normal vaginal environment. Therefore, it can be detected for only a short duration after sexual intercourse<sup>(3-8)</sup>. Acid phosphatase test can also give many false positive results to other body fluids and many products used in daily life<sup>(9)</sup>.

Nowadays, the prostate specific antigen (PSA) test is widely accepted for its application as an innovation to prove the presence of semen as forensic evidence in sexual assault cases. According to scientific results, PSA test is a confirmatory test or a diagnostic test for determination of semen. In a previous study, PSA test proved to be more accurate than the acid phosphatase test in all parameters of test (sensitivity, specificity, positive predictive value, and negative predictive value)<sup>(10)</sup>. Furthermore, PSA degrades slower than acid phosphatase in normal vaginal condition<sup>(3-8)</sup>.

Referring to the technical method, Enzyme Linked Immunosorbent assay (ELISA) is the conventional technique for PSA analysis and is valued as a quantitative test. In recent years, the PSA test kit has been studied for its substitution of the conventional ELISA method. The PSA test kit provides a less expen-

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sive, less time consuming, more convenient, and a better cost-utilization than the ELISA method. The PSA test kit has been proved by many studies that its accuracy is not significantly different from the conventional ELISA method<sup>(10,11)</sup>, and it could be beneficial for rapid detection of the semen. The PSA test kit is a semi-quantitative method using immunochromatographic principles.

In recent years, the PSA test kit became a new interest among forensic workers as an innovation for the detection of semen in sexual assault evidence. This is because of its better accuracy than the routinely used acid phosphatase method and its general acceptance as a confirmatory test or diagnostic test for the identification of semen in forensic specimens.

### Case Report

A 30 year old Thai female was found dead on the ground at the base of a small monument on Rajadumnern Road, Bangkok, Thailand clothed in sleeveless red T-shirt and naked bottom with blood stains around the victim's body, approximately 1,000 ml. The scene investigation was performed on the night of January 24<sup>th</sup>, 2006, around 10:00 PM.

Examination of the deceased body revealed the body of a middle-aged Thai female, esthetically built, marked pallor. Multiple wounds from sharp force injuries were observed over the neck and upper chest. External evidence of injuries was noted as:

1. Over the right side of the neck, there is a sharp edge stab wound continued from the incised wound, measuring 1.6 cm width, 9 cm in length, and at least 15.5 cm in depth, deep to zone one of the neck and upper anterior mediastinal space, cut through the trachea and right common carotid artery. The wound path is from back to front, right to left, and downward.

2. Over mid-anterior aspect and lower anterior aspect of the neck, there are two sharp edge stab wounds. The first wound is measured 1 cm width, 2.5 cm in length, and 6 cm in depth. The second wound is measured 0.3 cm width, 2.5 cm in length, and 3.5 cm in depth.

3. Incised wounds at right lower neck, size 0.8 cm width, 9.5 cm in length, 3 cm in depth, at left supra-clavicular area, size 0.3 cm width, 8 cm in length, 2.5 cm in depth, at right upper chest, size 0.7 cm width, 7 cm in length, 1.5 cm in depth, and at medial aspect of left shoulder, size 0.7 cm width, 2.5 cm in length, 2 cm in depth.

Special examination of the genitalia revealed:-

1. Abrasion wound at vulva area, measuring

1 x 2 cm.

2. Shallow laceration at right posterolateral aspect of the vaginal wall.

3. Abrasion wounds around the cervical os.

Subsequent autopsy (approximately 12 hours after death) revealed complete transection of the trachea at the level of 3.5 cm below the vocal cords, cut wound of right common carotid artery measuring 0.3 x 1 cm, and cut wound with hemorrhage of the neck muscles. Other internal organs are without special note. The cause of death was reported as a cut wound of the trachea and right common carotid artery due to stab and incised wounds over the neck (multiple sharp force injuries) and the manner of death is homicide.

Toxicological studies reveal the presence of ethanol in blood 395 mg%, the blood screening reveals positive for caffeine 1.51 g/ml.

The postmortem vaginal swab reveals negative for sperm and acid phosphatase but strongly positive for PSA test kit with confirmation by ELISA for PSA of 52.07 ng/ml.

### Discussion

According to investigation of the crime scene, the victim was found dead, with a naked bottom, which made the investigator suspect a sexual assault related death.

The external examination of the deceased's body revealed multiple wounds from sharp force injuries, which could explain the large number of blood stains at the crime scene.

Special examination of the female genital organs revealed an abrasion wound at vulva, shallow laceration at right posterolateral aspect of the vaginal wall, and an abrasion wound around the cervical os, which supported the suspicion of the victim's recent sexual episode prior to death.

Examination of the internal organs in this case provided a benefit for establishing the cause of death, which was a cut wound of the trachea and right common carotid artery due to stab and incised wounds at neck (multiple sharp force injuries).

The presence of ethanol in the blood at the level of 395 mg% could lead the victim to the comatose stage and probably inability to defend herself from the offender.

Postmortem vaginal swabs collected from the posterior fornix of the victim's vagina were done to investigate for a recent sexual assault episode prior to death.

The absence of spermatozoa by microscopic visualization method probably suggested that the male offender might be a vasectomized individual.

Negative for acid phosphatase test may probably be explained because the specimen was collected from the dead body in which acid phosphatase could be degraded more rapidly in a postmortem vaginal condition. As suggested by Hochmeister M et al<sup>(15)</sup>, the rough time estimation of maximum detectable time for acid phosphatase in a sexual assault case is 14 hours. On the other hand, PSA's maximum detectable time is longer (14-47 hours) in the antemortem vaginal condition; thus, the degradation time of biological proteins might be more rapid in a postmortem situation. According to another study by Simich JP et al<sup>(9)</sup>, mean vaginal decay time of PSA was found to be 27 hours. However, acid phosphatase from the same post-coital vaginal swabs showed a mean vaginal decay time of 14 hours.

The present result for the PSA test kit was strongly positive, which was confirmed by the high level of PSA ELISA quantitative method of 52.07 ng/ml. In general, the artifacts from either male or female's body fluids or even male urine shows an average level of PSA well below 52.07 ng/ml<sup>(4,12)</sup>. According to Samich JP et al, the reasonable cut-off value for negative samples was determined to be 1.77 ng/ml with a 99.997% certainty that no false positive had occurred<sup>(4)</sup>. Therefore, the authors can confidently conclude that this examined swab collected from the victim's vagina consisted of male semen.

Levine, Barry et al studied the use of PSA in the identification of semen in postmortem cases and revealed the agreement between the commercially available PSA immunoradiometric assay and identification by spermatozoa method in 67 of the 80 cases (84%). This indicates that the PSA method could be valid for detection and identification of semen in postmortem cases with a good result compared to the gold standard method of spermatozoa identification.

Finally, because the specificity and sensitivity of PSA in detection of the semen in vaginal swab specimens is better than acid phosphatase test<sup>(5)</sup> and because the acid phosphatase test is a screening test while the PSA method is a confirmatory test, the present report suggests use of the PSA test kit in addition to the conventional sperm smear and acid phosphatase test for sexually assault investigation in Thailand.

### Conclusion

This case is the first reported case in Thailand of the successful application of the PSA test kit as an

innovation for sexual assault investigation in a medico-legal case in Thailand.

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รายงานศพคดีและการตรวจทางนิติเวช กรณีข่มขืนกระทำชำเรา โดยใช้ชุดตรวจแบบรวดเร็ว  
หาสารจำเพาะ จากต่อมลูกหมาก (พีเอส เอ) ในการตรวจพิสูจน์ เปรียบเทียบกับ วิธีเดิมที่ใช้กันอยู่  
ในปัจจุบัน

เจตน์ ตาลทิพย์, อ่าง จิรจรรยาเวช, วิชาญ เปี้ยวนิม, กัลยาณี อตมศิริกุล, สมศรี ธีระกำจาย

รายงานศพคดีหญิงไทยอายุ 30 ปี พบนอนเสียชีวิตอยู่บนพื้นบริเวณฐานอนุสาวรีย์ขนาดเล็ก ย่านถนน  
ราชดำเนินในสภาพเปลือยท่อนล่างและมีกองคราบเลือดอยู่ด้านข้างรอบตัวผู้ตาย จากการตรวจชันสูตรศพ ณ สถานที่  
เกิดเหตุและการผ่าพิสูจน์ศพพบว่าผู้ตายเสียชีวิตจากบาดแผลถูกของมีคมตัดผ่านหลอดเลือดและหลอดเลือดแดงใหญ่  
บริเวณคอ ร่วมกับตรวจพบบาดแผลถลอกและบาดแผลฉีกขาดบริเวณอวัยวะสืบพันธุ์ภายนอกและภายในบริเวณ  
ช่องคลอดซึ่งสันนิษฐานว่าผู้ตายอาจถูกกระทำชำเราก่อนเสียชีวิต จากรายงานศึกษาหลายชิ้นอ้างอิงถึงการตรวจพิสูจน์  
ร่องรอยของน้ำอสุจิโดยการตรวจหาสารจำเพาะจากต่อมลูกหมากหรือ พี เอส เอ ว่ามีความแม่นยำของผลการตรวจ  
ที่ดีกว่าวิธีการตรวจแอซิดฟอสฟาเตสที่นิยมใช้กันแพร่หลายในปัจจุบันในประเทศไทย รายงานนี้ได้วิเคราะห์ถึง  
ประสิทธิภาพ ข้อดี และ ข้อบกพร่อง ของวิธีการตรวจต่าง ๆ ในการพิสูจน์ร่องรอยของการกระทำชำเรา ทั้งวิธีการ  
ตรวจหาตัวอสุจิโดยกล้องจุลทรรศน์ การตรวจวิธีทางเคมีแอซิดฟอสฟาเตส และการใช้วิธีใหม่คือการใช้ชุดตรวจแบบ  
รวดเร็วหาสารจำเพาะจากต่อมลูกหมาก (พี เอส เอ) ซึ่งได้ผลแตกต่างกันอย่างเด่นชัดในคดีศพตัวอย่างนี้