CASE REPORT

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Metropolitan Forensic Anthropology Team (MFAT) Case Studies in Identification: 3. Identification of John J. Sullivan, the Missing Journalist

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ABSTRACT: Skeletal remains removed from an unmarked grave in El Salvador were intensively studied by a team of forensic science experts. Even though the skull, teeth, and several major bones were missing, a positive identification was made of the missing journalist. This was contrary to reports submitted to the State Department by Salvadorian officials. All of the methods used in this investigation, which includes a new method for simultaneously assessing sex and race by discriminant function analysis that was tested by application, are fully described. The international background of this case and information regarding the cause of death is discussed.

KEYWORDS: physical anthropology, human identification, musculoskeletal system

Background

John Sullivan, a freelance reporter who was sent to El Salvador by *Hustler Magazine* to write an article, disappeared on 28 Dec. 1980, several hours after checking into the Sheraton Hotel in San Salvador. The family was informed that he was missing for the first time on 6 Jan. 1981 when an Associated Press reporter called them. Numerous efforts by the Sullivan family to apply pressure on the American and Salvadorian governments for an explanation of his whereabouts or location of the body were unsuccessful.

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Out of desperation, the family placed advertisements every week for 15 months in the Salvadorian newspapers offering a reward for any information regarding his whereabouts. This resulted in a series of letters from an informant in El Salvador who identified himself as a member of the team that killed him. The first letter indicated that he was mistaken for a Leftist Belgian priest causing him to be captured, tortured, and killed. It further stated that he had $500 on him and that he begged for his life to no avail. A second letter was confirmed by a handwriting analyst to be the same individual that wrote the first letter. This gave details of a scar on his left leg. A third letter indicated that Sullivan's body was buried in Nuevo Cuscatlan, about 30 km (20 miles) south of the capital, and was witnessed by several town officials. A final letter in June of 1981 afforded additional details and a map of the burial site.

United States aides found records of an unidentified mutilated body buried in a shallow grave on 29 Dec. 1980, the day following Sullivan's disappearance. The body was then exhumed in July of 1982 (Fig. 1), and skeletal remains were examined by Salvadorian forensic science specialists who reported that the osseous age and the X-rays were between 40 to 45 years, that the height was 1.73 m according to their anthropological measurements, and that the X-rays taken of the deceased did not correspond to the X-rays of the right knee of John Sullivan that was submitted to them. In their opinion, the remains were not those of John Sullivan. The Justice of the Peace and a clerk in the Nuevo Cuscatlan jurisdiction also submitted an inspection report of an unidentified body of a man found in a drain along the edge of the National Highway at Plan de Lopez in the Nuevo Cuscatlan jurisdiction. The report indicated that the deceased was about 35 years of age, had a stocky build, had an almost white complexion, hairy arms and legs, amputated hands, measured approximately 1.75 m tall, and was dressed in a discolored, very worn pair of pants with no shirt. It further related that death appeared to have been caused by an explosion of some sort of device, that no stab or bullet wounds were present and that the cranium, face, pectoral region, viscera, and front of the thighs were all destroyed.

X-rays of the knee taken by the Salvadorian forensic science officials were compared here to the microfiche radiographs of the left knee which had been taken in 1972 at Hackensack Hospital, following knee injury. Unfortunately, there was difficulty of comparison, since the microfiche radiographs were taken by the usual AP lateral and tunnel projections, while the full-size X-rays taken by the Salvadorians were taken in oblique projections. There was, how-

FIG. 1—*Exhumation of body in shallow grave in July 1982.*

ever, a striking similarity of the epiphyseal line, both in size and shape of the line, and of other details of the proximal end of the tibia which proved to be important identifying features. In addition, none of the individual morphological features in the entire knee joint of both sets of X-rays were inconsistent with each other. Request was then made through the Department of State to have the remains of John J. Sullivan sent here for additional X-rays of the knees and anthropomorphic studies. Salvadorian officials refused, citing a law prohibiting the shipment or transfer of unidentified remains out of the country. Initial efforts were made by U.S. Congresswoman Marge Roukema (New Jersey), to no avail; but later U.S. Congressman Robert Torricelli (New Jersey), Member of the House Foreign Affairs Committee, which oversees the renewal of military aid to El Salvador, made an unofficial tour of the country. Congressman Torricelli finally convinced the Salvadorian officials that it was in their best interest to have the remains shipped to the United States for testing.

Arrival of Skeletal Remains

The cargo designated as "Human Remains" arrived at 12:18 a.m. at Newark International Airport via Eastern Airlines from Miami and arrived at the cargo area of Eastern at 12:50 a.m. on 20 Feb. 1983. A member of the Rockland County Medical Examiner's Office picked up the parcel at that time with the office van. Also present at the airport were Donna and John Igoe and Debbie and Joseph Indrieri—the sisters and brothers-in-law of John J. Sullivan, and Jamie Fox and Rob Esposito—representatives of Congressman Robert G. Torricelli's Office.

The remains were contained in a dark royal blue canvas bag sewn on both ends with a blue mattress stitch. The bag was addressed in large yellow letters to Dr. Zugibe at the Rockland County Medical Examiner's Office and included the telephone number of the Medical Examiner's Office and Dr. Zugibe's. The package bore an orange-red express label with origin code 202 MIA 12625814 Final Destination EWR Total weight 71.

At the Medical Examiner's Office, the package was photographed, the blue mattress stitch on one end was removed, and an infant's casket was pulled out. This was a variegated brownish tan wooden infant's casket that had the appearance of metal with a rounded top door measuring 1080 mm in length by 419 mm in width by 356 mm in depth (42½ by 16½ by 14 in.). The main door contained a small door which independently opened exposing a viewing window. Within the casket was a sheet metal rectangular box conforming to the inside of the coffin. This box was soldered closed with lead solder. This box measured 978 mm in length by 343 mm in width by 184 mm in depth (38½ by 13½ by 7¼ in.). A propane torch was used to melt the solder and open the box. The sheet metal box contained two heavy-duty orange plastic bags with one placed inside the other. This bag, plus its contents, weighed a total of 10 kg (22 lbs). Within this bag was a black plastic bag containing dark brown to black dirt which was admixed with skeletal parts, wood particles, stones, roots, and fragmented pieces of material (cloth). The contents, other than the skeletal parts weighed 3.6 kg (8 lbs.), affording a weight of 6.4 kg (14 lbs.) for skeletal parts.

Preliminary Evaluation

The skeletal parts were carefully removed from the dirt and laid out on an X-ray stretcher (Fig. 2), photographed, and X-rayed together. Pieces of material (fabric) were also laid out and photographed.

Several zipper teeth were scattered over the X-ray and were found in the dirt that had dried and attached to the bones; a small metallic fragment was present on the X-ray of the centrum of the second lumbar vertebrae and corresponded to a smooth coin-like piece of metal found in the dirt that had dried to the centrum of the second lumbar vertebra.

Preliminary full-size X-rays were taken of the bones comprising the left knee area and compared to the full-size X-ray of the knee identified as 12-7-82 clinica forense, San Salvador, 10-82,

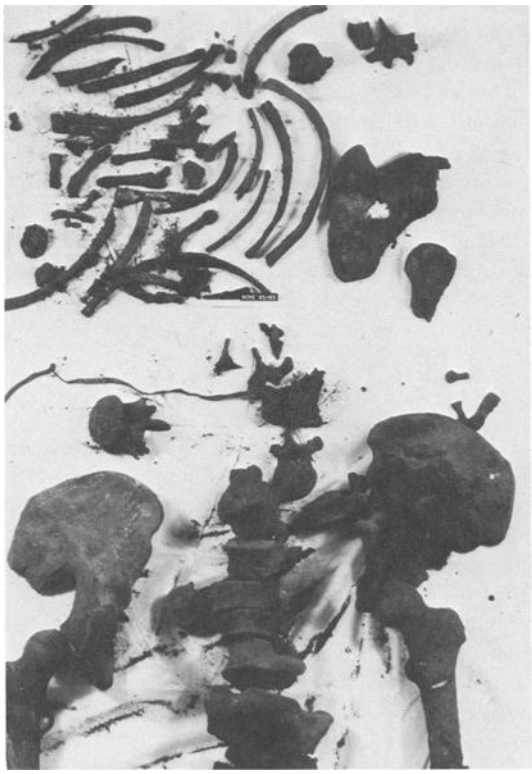


FIG. 2—*Skeletal parts were laid out on an X-ray stretcher.*

which had previously been taken of the remains in San Salvador. This was done to verify that these were the same skeletal remains as those in the X-ray taken in San Salvador in October 1982. The major morphological features compared favorably and scattered zipper teeth were noted in both films. A few of the zipper teeth were removed from the dirt that had caked onto the bone responsible for the X-ray pictures of the zipper teeth.

These X-rays were also compared in preliminary fashion to the microfiche films taken of John Sullivan at Hackensack Hospital on 30 Aug. 1972 (identified as 469483 left). Each morphological region of the femur and tibia was compared and showed no dissimilarities on cursory examination and appeared consistent with one another.

The dirt was sifted for the presence of skeletal parts, clothing parts, or other items of interest; and only roots, fragments of wood, and stones were found.

Forensic Anthropology

Condition of Skeletal Remains

With the exception of two fragmentary and unnumbered thoracic vertebrae, none of the vertebrae superior to T6 were present. Also missing were the complete skull, the right pectoral girdle and the long bones of the right upper limb. The left pectoral girdle lacked the clavicle, and the left scapula was broken transversely at the level of the spine. The left upper limb preserved only the proximal end of the humerus to a level slightly below the surgical neck. Some of the car-

pal bones and hand phalanges were preserved. In the rib cage the manubrium, body, and xiphoid process of the sternum were missing and the ribs bore multiple fractures.

With the exceptions of the missing left patella, the fragmentary T9, and the sacrum, which was broken transversely at the level of the union of S2-S3, the bones inferior to T6 (including T6) were all well preserved. The bones of the pelvis and T9 were, however, charred in some areas.

No soft tissue was preserved externally, and neither grease nor the odor of decay persist. No animal teeth marks were apparent.

Assessments Requested

It was requested that the age at death, sex, race, stature, body type, and any information developed that would be useful for the identification of the remains be supplied. Also, that findings be compared with information received on John Sullivan, missing person, for a possible match (positive ID).

Method

To maintain objectivity in developing assessments from the skeleton of 83-83 for a possible match with information received on John Sullivan, we emphasized osteometric and discriminant function methods in our analysis and in our report. At the same time, it is important that our inspectional analysis corroborated all of the findings achieved with our objective methods.

Age

Primary criteria for age estimation include incomplete fusion of the S1-S2 segments of the sacrum (Fig. 3—central tendency mid to late twenties) and evaluation of the metamorphosis of the pubic symphysis according to the method of McKern and Stewart [*1*] total score 13, age range 23 to 39, mean age 29.18, standard deviation 3.33. This age estimate of second half of the third decade was supported by the following corroborative age criteria: lipping was absent

FIG. 3—*Incomplete fusion of the S1-S2 segments of the sacrum.*

on the thoracolumbar spine, the border of the glenoid fossa of the scapula, and the inner margin of the patella; although exostoses were well marked on the margin of the obturator foramen, lipping was very slight on the iliac crest and on the inner surface of the ischial tuberosity, and did not extend forward on the ischial ramus (for a recent review of age estimation criteria, see Stewart [*2*]).

The more moderate lipping on the distal femur (right and left) and on the anteromedial border of the lateral tibial condyle (left) and the spur formation on the ankle joints contrasted sharply with the youthful appearance of the other joints and suggests, therefore, traumatic origin.

Race and Sex

Race and sex were assessed simultaneously as white male by multivariate discriminant function analysis. Our 15-variate discriminant function analysis for classifying the innominates and femora of American white and black males and females was selected because (1) the skull was missing and (2) the living stature (178 ± 6.54 cm, or about 5 ft. 10⅛ in. with a range of a bit over 5 in.), estimated from maximum length of the right femur (490.5 mm), is so much greater than the mean stature for Nahua-Pipil males from El Salvador, 156 cm (5 ft. 1½ in.) (*Handbook of Middle American Indians 1970* [*3*]) that an Indian racial background seems highly improbable. The preserved hair, which is light in color and straight, also suggests a non-Indian and non-black classification, leaving white as the probable racial type. The discriminant function scores, based on eleven measurements of the innominate and four from the femur are as follows: discriminant function No. 1 (sex), 1.9038598; function No. 2 (race), 2.7598294; function No. 3, which is also used for our classification, 1.249405. The posterior probability of membership in the white male group for this case is 0.9998 (for a discussion of race and sex assessment of the postcranial skeleton by discriminant function analysis, see DiBennerdo and Taylor [*4*] and Taylor et al [*5*]).

Race, Inspectional Analysis

Observational traits that support the white classification based on osteometric and multivariate discriminant function analyses include the following: the femoral shaft was bowed and the pilaster on its posterior border was well developed; the epiphyses of the bones of the lower extremity appeared large relative to maximum bone length; vertical height of the ilium (from acetabulum to iliac crest) is large relative to maximum femoral length; and the cotylosciatic breadth and lengths of the pubes and ischium are great.

Sex, Inspectional Analysis

Observational traits that corroborate the male classification based on osteometric and multivariate discriminant function analysis include the following: the sciatic notch was narrow; the ilium was high; the ischium was long relative to pubic length; the acetabulum was large; the breadth of the central portion of the ilium (cotylosciatic breadth) was great; the body of pubic bone was large and triangular and the three observational traits of the pubis used in the sexing method of the phenice are clearly male (convexity of the subpubic medial border; absence of the ventral arc; and thickness of the inferior border of the inferior pubic ramus); the long bones were long and robust (shaft circumference was great absolutely and relative to maximum length); and the epiphyses of the long bones were large; muscle markings are large and prominent.

In summary, the general massiveness of the skeleton indicates adaptation for considerable weight transmission and large muscle attachment.

Height

Living stature is estimated from the maximum length of the right femur (490.55 mm) with the regression formula of Trotter and Gleser [*6*] for American white males as 178.03 ± 6.54 cm, or about 5 ft. 10⅛ in. with a range of slightly over 63.5 mm (2½ in.) on either side of the height estimate. The height range is based on ±2 standard error (SE) for the femoral equation of Trotter and Gleser. By doubling the SE, we maintain the limits of 95% certainty in living stature estimation, and thereby refute part of the evidence presented by the Salvadorian forensic scientists for their exclusion of the remains as those of John Sullivan. The inescapable wide range for the height estimate is required because of intrapopulation variation in limb to trunk ratio.

Pathological and Anomalous Features

There was remodeled bone on the posterior surface of the right tibia and pitting adjacent to the interosseus crest of the same bone, suggestive of subperiosteal ossifying hematoma. The left femur was 5 mm shorter than the right femur and the left tibia is similarly slightly shorter than the right tibia. In a right-handed individual, the left tibia is typically slightly shorter than the right [*1*], but the left femur was slightly longer in the present case, thus presenting an atypical lower limb length asymmetry, which may reflect the reported unusual gait of the victim. Finally, the only joints that showed moderate lipping or osteophyte formation or both were the ankles and knees.

Individualization

The remarkable robusticity of the innominates and of the long bones of the lower limbs, and the size and relief of the areas of muscle attachment, suggest a strong, well muscled male. The carpal bones, first metatarsal, and phalanges of the great toe were articulated and luted together with wax. The foot skeleton of Case 83-83, with its medial border intact, was then placed on the right shoe identified as that of John Sullivan's and compared for size (Fig. 4). The shoe

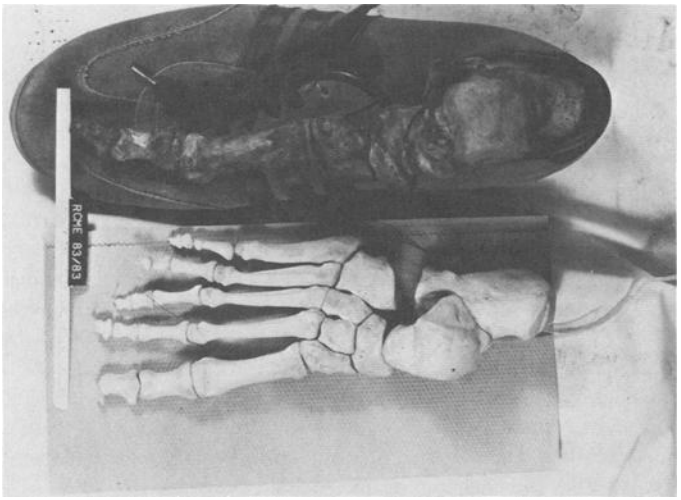


FIG. 4—*The foot skeleton of Case 83-83, with its medial border intact, was placed on the right shoe identified as that of John Sullivan's and compared for size. The foot skeleton placed below the shoe is used for anatomical comparison.*

fits, and the large size of the bones, which comprise the medial border of the foot, the major pathway of weight transmission forward to the balls of the foot, and the large shoe, conjointly indicate a heavy body weight.

Summary

The skeletal remains of Case 83-83 are assessed as those of a young adult white male. The age of death is estimated as middle to late twenties, and the living height is estimated as 178 cm (5 ft. 10⅛ in.) with a range of a little over 63.5 mm (2½ in.) above and below the estimate. Although the skull and several postcranial bones are missing (see *Condition of Skeletal Remains*), the excellent condition of the recovered bones permits unqualified, confident assessment. The agreement of all assessments generated by inspectional, osteometric, and discriminant function analysis of the skeletonized remains of Case 83-83 with identification information received on John Sullivan, missing person, supports the positive identification indicated by comparison of antemortem and postmortem X-rays of the left knee. It is equally significant that none of our findings suggests a possibility of exclusion.

Forensic Radiology Report

As mentioned in the introduction, a major basis for the exclusion by the Salvadorian forensic scientists of the remains under discussion as those of John Sullivan was comparison of postmortem X-rays taken in different orientations with those of the antemortem X-rays of John Sullivan. We have corrected this methodological error. The proximal left tibia was radiographed in numerous projections with varying degrees of angulation and rotation. These radiographs were then compared to enlargements that we made of the microfiche reproductions taken at Hackensack Hospital on 30 Aug. 1972. The original microfiche reproductions were of poor quality and quite faded.

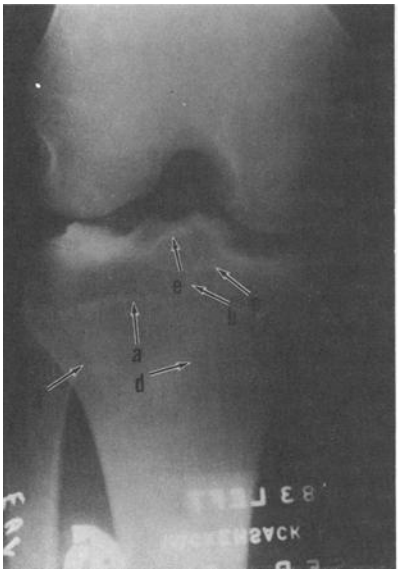
There were several distinctive features on both the radiographs of the proximal tibia as visualized on the microfiche and the tibia which we performed (Figs. 5 and 6, respectively). These include a prominent transverse band of increased density in the lateral half of the proximal tibial metaphysis (Figs. 5*a* and 6*a*). This may represent the plane of closure of the proximal tibial epiphyseal plate.

A somewhat unusual and almost vertically oriented line of increased density extended from the medial end of this transverse band superiorly, towards the intercondylar eminence of the tibia (Figs. 5*b* and 6*b*). An additional less prominent transverse band was noted beneath the medial tibial plateau which crosses the vertical line of increased density as well (Figs. 5*c* and 6*c*).

In addition to the fairly distinctive features noted above, there was a prominent trabeculation noted in the proximal tibial shaft which is vertically oriented and is virtually identical on the two studies (Figs. 5*d* and 6*d*). Another fairly distinctive feature was a horizontal band of increased density which is actually in the intercondylar eminence of the proximal tibia (Figs. 5*e* and 6*e*). There was another vertical line of increased density in the lateral aspect of the proximal tibia (Figs. 5*f* and 6*f*). Careful examination of all the features of the two studies demonstrate no features that are in any way different between the two, such as to suggest that they may not be radiographs of the same tibia.

Based upon all the features noted above, it was concluded that both of these studies were obtained of the same tibia. The possibility of another tibia having these identical features may exist; however, this possibility should be considered as extremely remote.

In summary, the radiographs of the proximal tibia identified as Rockland County Medical Examiner's Case 83-83, and the radiographs of the knee identified as Hackensack Hospital 469483, were both taken from the same bone.



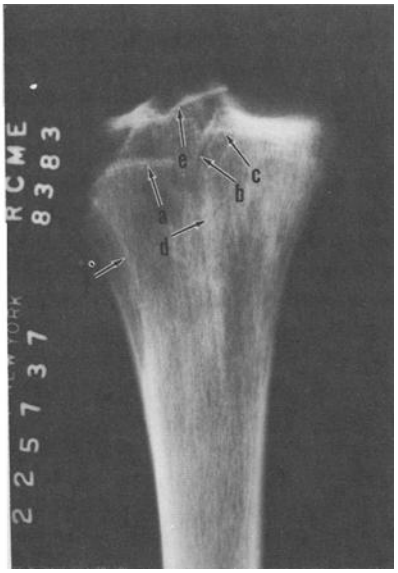


FIG. 5 (left)—*Several distinctive features were on both the proximal tibia as visualized on the microfiche and* FIG. 6 (right)—*radiograph of the tibia which MFAT did, such as* (a) *prominent transverse band of increased density in the lateral half of the proximal tibial metaphysis;* (b) *somewhat unusual and almost vertically oriented line of increased density extending from the medial end of this transverse band superiorly towards the intercondylar eminence of the tibia;* (c) *less prominent transverse band beneath the medial tibial plateau which crosses the vertical line of increased density as well;* (d) *prominent trabeculation in the proximal tibial shaft which is vertically oriented and identical on both figs.;* (e) *horizontal band of increased density which is actually in the intercondylar eminence of the proximal tibia; and* (f) *another vertical line of increased density in the lateral aspect of the proximal tibia.*

Fabric Remains—Gross

Fabric was examined and photographed both before and after washing in a mild solution. A small piece of corduroy material, which was light brown to tan in color, with a mass of frayed fibers, was present to which three black colored pockets were attached. The pockets contained slits along each one of them. A zipper slide piece was attached to a couple of threads. A rusted metal rivet was still attached to one part of the material. The corduroy had eight wales to the inch and a label cut through the words "Made in USA," was attached and sewn into a seam. Another piece of material, which appeared to be synthetic blue mesh measured 84.5 cm in length by 18.5 cm in width. A seam was present along one edge. A greyish-white material was present in three pieces. This was canvas-like in texture and soiled and measured 62 by 40½ cm, 26 by 37½ cm, and 47 by 19 cm. No buttons were present. Soiled tan-colored shorts were found which were torn along each lateral side. No fly was present and fits the description of bikini-type shorts. No label or size indicated. Two socks, tan in color, both of which were marked with the same pattern, were ribbed with a design from the top of the sock to the toe. The socks measured 41 cm from the top of the sock to the tip of the toe and 24½ cm from the Achilles area to the toe.

Microscopic Features

The microscopic features of the fibers constituting the corduroy fabric consists of translucent tape-like, flat, and twisted areas characteristic of cotton. The fibers in the socks consist of

pseudocrystalline properties with some birefringence consistent with a synthetic polyester-like fiber. The fibers in the undershorts consist of a mixture of translucent, tape-like, flat, twisted fibers mixed with pseudocrystalline-type fibers with both types apparently in an almost equal distribution, consistent with a mixed cotton-synthetic polyester-like mixture. Fibers in the greyish-white fabric also consist of a mixture of the same type of fibers as in the undershorts but with a preponderance of the cotton type over the synthetic polyester-like fibers. The blue fabric essentially consists of fibers with pseudocrystalline properties characteristic of synthetic polyester-type fibers with a smaller percentage of fibers with the properties of cotton. Samples of each of the above mentioned fibers were burned and afforded properties consistent with the above findings.

In summary, the tan corduroy fabric with eight-wale cotton corduroy weave with a label "Made in U.S.A." and the bikini-type underpants composed of cotton and synthetic fibers corresponds to the description afforded by the family. The grayish tight weave fabric composed of cotton and some synthetic fits the description of the material from the poplin jacket described by the family, and the blue fabric composed of synthetic fibers with cotton was consistent with the description of an Adidas type of jogging undershirt also described by the family. The socks, primarily composed of synthetic material, were consistent with the shoe size of John Sullivan.

Forensic Pathology Observation

The condition of the skeletal remains, described above in **Forensic Anthropology,** is consistent with severe destruction to the upper part of the body. The anterior and anterolateral rib destruction is consistent with a severe force applied to this region of the chest. This is supported by the Inspection Report of Armand Augusto Palma, Justice of the Peace, regarding his evaluation of the body on 29 Dec. 1980. In this report, he indicates that the pectoral parts were destroyed. Moreover, this type of damage to the body is consistent with an explosive type of blast to the upper part of the body which is also consistent with the report of Armand Augusto Palma who relates "Death appears to have been caused by the explosion of some sort of device because there are no bullet or stab wounds," as well as his observation that "the cranium and face, pectoral and visceral part and fleshy front part of the thighs were destroyed."

A plastic or dynamite type of explosive was probably used because of the total absence of any radiopaque fragments on the X-ray film. Whether such an explosion occurred before or after death cannot be determined with certainty. The presence of the burned areas with carbonization to the sacrum, pelvis, and ninth thoracic vertebra is suspicious of an attempt to destroy the remains by conflagration and, perhaps, accounts for some of the other missing bones.

Hair Fibers

Several fibers found in the dirt were identified microscopically as human hair. For the most part, they are relatively short hairs with finely tapered tips and very irregular cross sections. When iso-refractile longitudinal mounts were prepared and examined microscopically, it was found that the hairs were badly damaged presumably because of microbial/enzymatic attack from organisms in the soil at the grave site in El Salvador. Much of the damage is unlike any seen in hairs from other grave sites. Any conclusions drawn to date must be regarded as tentative.

Although the hairs remain essentially intact, the interior of the cortex is damaged to such an extent that many of the diagnostic features useful in determining racial origin are either absent or compromised. Even the issue of somatic origin is unclear. For example, large numbers of what seem to be non-black pubic hairs appear to dominate the sample. However, the presence of hairs from an untrimmed beard cannot be excluded.

Conclusions

Two crucial methodological errors underlie the erroneous exclusion by the Salvadorian forensic scientists of the remains of the present case as those of John Sullivan:

(1) a height range based on ± 1 SE instead of ± 2 SE and
(2) an attempt to compare antemortem and postmortem knee X-rays taken in different orientations.

We have concluded that the skeletal remains submitted to us from El Salvador are those of John J. Sullivan, the missing journalist. The basis of our conclusion is as follows:

1. Extensive anthropological studies confirmed that the age, sex, race, stature, and general body size of the skeletal remains corresponds to the information received for the identification of John J. Sullivan. None of the skeletal features suggested an exclusion, while the concordances in classification are numerous.
2. Extensive radiological studies of the left tibia of the skeletal remains compared to enlargements of the microfiche films of the tibia of the left knee of John Sullivan taken at Hackensack Hospital on 30 Aug. 1972 revealed identical features indicating that they were taken from the same bone.
3. The remnants of clothing and shoe size corresponds to the information regarding the clothing and shoe size supplied by the Sullivan family.
4. The 5-mm length dominance of the right femur over the left, and of the right tibia over the left, appears to correspond to a peculiar nondescript gait possessed by John J. Sullivan.
5. Of major importance in the above studies is the absence of any contradictory findings.
6. Forensic pathological studies are consistent with an explosion to the upper part of the body causing marked destruction. It is not possible to say with certainty whether the explosion was applied before or after death. This certainly should prompt a complete investigation of all of the facts surrounding this death, now that we have a positive identification.

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