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# A 5-year study on DNA recovered from fingernail clippings in homicide cases in Milan

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## Abstract

In 1996, the collection of fingernail clippings on a routine basis started in cases of homicide from stab wounds at the Institute of Legal Medicine of the University of Milan. A total of 179 homicides was observed in the period 1996–2000 and a Court order for the examination of fingernail debris (DNA typing) was issued in 31 of them. The results obtained were informative (presence of an additional profile) in 11 of 31 cases; 3 of them were inconclusive; 17 were negative (no additional profiles detected). These results demonstrate the usefulness of routine fingernail clipping during the autopsy in homicide cases when a struggle is suspected.

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## 1. Introduction

A well-known source of DNA in assault cases is represented by debris recovered from under the fingernails, often originating from tiny tissue fragments scratched from a suspect's skin [1,2]. The collection of fingernail clippings before autopsy in cases of death from stab wounds or when a struggle may have occurred (e.g. strangulation, beating, hanging, throttling), on a routine basis, started at the Institute of Legal Medicine of the University of Milan in 1996. The present study was performed to evaluate the actual value of DNA typing of the debris recovered from under fingernails collected during the autopsy in homicide cases in the years 1996–2000. The results we obtained confirm the usefulness of this approach in the recovery of a suspect's DNA profile.

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## **2. Samples**

A total of 179 autopsies in homicide cases was performed at the Institute of Legal Medicine in Milan in the period 1996–2000, 60 of them were from stab wounds, 72 from gunshots, 47 from other causes. The autopsies performed represent the total number of homicide cases in the Milan area. In 66 cases, fingernail clippings were collected and stored for possible DNA typing. A Court order for their examination (DNA typing) was issued in 31 cases. Plastic bags were wrapped around each hand either at the crime scene or when the body arrived at the morgue before autopsy.

## **3. Evidence collection**

Each fingernail was collected before the autopsy in the autopsy room following strict procedures to avoid contamination. Each fingernail was clipped with sterile scissors and forceps and put separately into 1.5-ml previously labelled tubes. In each case, a blood reference sample was collected from the corpse and separately stored. The collection of other evidence (e.g. vaginal swabs) was performed case by case depending upon the circumstances of the case.

## **4. Materials and methods**

DNA was extracted (organic phenol–chlorophorm) from the material that had been recovered by washing several times the lower surface of each nail clipping with a pipette with a filter tip. In order not to lose evidence, no preliminary examination aimed at the identification of the recovered material was carried out. During the years 1996, 1997 and 1998 (first half), singleplex PCRs with the systems TH01, TPOX, CSF1PO (CTT Promega), F13B, FGA, FES/FPS, D19S253, D21S11, SE33, vWA were performed. The number of loci investigated was dependent upon the amount of DNA available case by case. Amplification conditions, resolution of fragments, gel electrophoresis and silver staining procedures were performed as published elsewhere [3–7]. Since the second half of 1998 up to the end of the period considered for this study (2000), fluorescent detection of multiplex amplified products was used (ABI Prism 373A). The commercial kits AmpflSTR Profiler™, Profiler Plus™ and SGM Plus™ (PE Biosystems) and Powerplex 16™ (Promega) were used according to each manufacturer's manual.

## **5. Results**

The results obtained were considered “informative”, “negative” or “inconclusive” when additional profiles, no additional profiles, no profile at all or non-reproducible profiles were detected, respectively. An additional profile is the profile other than the victim's. Additional profiles were detected in 11 out of 31 cases. In 7 out of 11

cases, the additional profile matched the suspect. In the remaining 4 cases, an additional profile was detected but no comparison was possible as no suspects were available at the time of the investigation. No additional profiles (“negative” results) were detected in 17 of 31 cases, while 3 of 31 were inconclusive. Inconclusive profiles were declared either when no two amplifications showed the same result (low copy number, stochastic effect) or when the obtained profiles showed intensities below 100 rfu, or when there was marked peak imbalance in the minor component of the mixture.

## 6. Discussion

In most cases, variable proportions of two DNA components were detected, one of them originating from the victim. In some instances, the additional profile was the major component in the mixture. The interpretation of the mixed profiles was performed according to Clayton et al. [8] and the report was written correspondingly. The number of systems in the multiplex reactions performed ensured a higher degree of discrimination power when compared to singleplexes, as expected. In the relatively limited survey analysed, no preferential sites (fingers) for the recovery of additional DNA were observed. In other words, mixed profiles were observed under the nails of all of the fingers. Moreover, each case displayed a different involvement of each of the fingers: in some cases, additional DNA profiles were present only under one or two nails from one hand, while in other cases, many more fingers from both hands were involved. Debris under the nails are anatomically “protected” against contamination from exogenous material. This is one of the reasons why the detection of an additional profile in this site can be of great value in the reconstruction of a homicide case. Nevertheless, every precaution against external contamination was carried out starting from the crime scene by placing plastic bags on each hand; as far as laboratory procedures are concerned, special precautions against contamination were adopted [9]. It can be observed from the obtained result that more than 35% of cases (11 of 31) showed an additional profile indicating the occurrence of a contact between victim and another individual(s), in 7 of 11, these showed a match with the suspect’s profile. As reported, in four cases, an additional profile was detected but no suspects were available for comparison. DNA databases have the potential to enhance the possibility of identification of the foreign profile in such cases. It cannot be ignored, however, that the detection of an additional profile could also be due to ante-mortem activities not necessarily related to the homicide, also because no information on the origin of the collected debris was available as no preliminary identification of the recovered material had been carried out. Therefore, the information gathered from this analysis has never been over-emphasised in the presentation of the results, as it is the jury’s role to link it with all the other information available in the case. Nevertheless, the routine collection of such kind of evidence should always be performed in violent crimes because of its great value both in exclusionary cases and in the reconstruction of the circumstances of a crime, especially when legitimate or illegitimate contact between the victim and the suspect is denied.

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