Use of cadaveric stem cells: analysis of literature

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Abstract. Determination of Post Mortem Interval (PMI) has always been based on empirical analysis of microdata not always endowed with sufficient reliability. Due to its significance in medico-legal issues, PMI estimation needs to be assessed by applying new and more reliable methods and/or biomarkers. Considering the growing interest and use of stem cells taken from cadaveric tissues and the success in their isolation from death donors, with the maintenance of vitality and regenerative capacity, we evaluated the Literature “state of the art” on this topic to understand if those stem cells could also be used for thanatochrologic estimation. The results obtained from Literature analysis show the possibility of using these cells as a marker for the post-mortal interval. In particular Mesenchymal Stem cells, isolated from adipose and muscular tissues, can be used to evaluate their regenerative capacity over time according to the PMI.

Keywords: Post Mortem Interval, PMI, stem cells, cadaveric tissue, forensic medicine.

INTRODUCTION

Post mortem interval (PMI) is defined as the elapsed time since the death of an individual. Assessing PMI is one of the most difficult task and recurrent challenge in forensic pathology due to the influence of various intrinsic and extrinsic factors, but it is of fundamental importance in medico-legal issues.

Due to its significance and complexity, PMI estimation needs to be assessed by applying new and more reliable methods and/or biomarkers and this, in recent years, is reflected by an increasing focus of research in thanatochronology.

Several methodological approaches have been proposed but, to date, none of these resulted to be reliable for forensic purposes.
Considering the growing interest of regenerative medicine in cadaveric stem cells with a view to minimize ethical problems associated with their obtainment, we evaluated the Literature “state of the art” on this topic to understand if those stem cells could also be used for thanatochrologic estimation.

MATERIALS AND METHODS:

A review of publications was performed using PubMed database. The search was limited to work and studies published in English. Key words included were: stem cells, forensic medicine and/or cadaver.

373 articles were found. Exclusion criteria were: case reports, trials, reviews, book chapters, articles with unavailable fulltext and studies performed on brain dead but beating heart donors.

A total of 91 studies were retained, involving both human and animal cadavers.

RESULTS:

15 of the analyzed articles used only animals of different specimens, 65 focused just on human cadavers, 7 compared results between human and animals cadavers while the remaining 4 compared results between human cadavers and living donors.

The most sampled tissues were the ones derived from eye ball like corneas, conjunctiva, retina and ciliary body (30 articles), followed by bone marrow (23 articles) and central nervous system (14 articles).

Considering the type of stem cells studied, large majority of Literature focused on limbal stem cells, mesenchymal stem cells and hematopoietic stem cells with 18, 16 and 13 studies respectively.

All the articles aimed at finding useful tools for regenerative medicine purposes, while 2 studies also considered data of medico-legal interest, but only as collateral observations.

DISCUSSION:

The aim of this work is to evaluate the possibility of using stem cells as a marker for post mortem interval estimation in medico-legal issues. The idea to focus on cadaveric stem cells arose from the growing interest, especially in regenerative medicine field, on deceased donors in order to avoid ethical controversies.

Literature analysis permitted to underline that cadaveric stem cells are successfully isolated from various tissues and that, within a certain timeframe, they maintain viability and proliferative capacity. To evaluate which stem cells could be most suitable for forensic purposes, we initially focused on the most studied organs in Literature which resulted to be eye, bone marrow and the central nervous system. However, none of these organs are particularly useful in medico-legal analysis as they undergo rapid degradation after death, cannot be sampled in all the contexts (i.e. site inspection) and moreover are often affected by pre-death patients clinical conditions.

We then focused on the most studied types of stem cells that resulted in limbal, mesenchymal and hematopoietic by analysing 18, 16 and 13 articles, respectively.

Of these three types of cells, the first and third ones are collected almost exclusively from eye ball tissues and bone marrow respectively, and therefore are scarcely useful for forensic purposes for the reasons afore mentioned, while mesenchymal cells are of greater interest as they derive from various tissues, (see Table 1).

In particular muscular and adipose tissues are considered superior by some studies in terms of proliferative and differentiative capacity if compared to other tissues such as bone marrow. Moreover these tissues are very resistant to ischemic insults, are easily accessible for sampling and they are little affected by the most frequently pre-existing pathological conditions and by the cause of death of an individual.

CONCLUSIONS

Despite the growing interest and use of stem cells taken from cadaveric tissues and the success in their isolation from death donors, with the maintenance of vitality and regenerative capacity, very little attention is given to their potential use in forensic medicine, in particular for thanatochronological purposes.

The results obtained from Literature analysis, although still limited, show the possibility of using these cells as a marker for the post-mortem interval. In particular adipose and muscular tissues can be used also in comparison, to evaluate the regenerative capacity over time of stem cells according to the PMI.

REFERENCES

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<td>Eslani M.</td>
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<td>Parks K. S.</td>
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<td>Valente S.</td>
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<td>Saito T.</td>
<td>Confirm whether human postmortem ASCs can be collected and culture-expanded from cadavers</td>
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