Supplementary material

# Methods

**Donor management**

All donors had poor neurological outcomes, which were confirmed by various tests such as brain computed tomography, electroencephalogram, evoked potentials, and neurological consultation. These investigations revealed that the neurological condition was irreversible. The retrieval of organs was documented by the Transplantation Informative System and other clinical documents. The consent for organ donation was obtained either from the donors themselves or their family members, and everything was handled in accordance with Article 23 of Italian Law 91/1999. “All donors who donated for DCD (Donation after Cardiac Death) were classified as Maastricht III according to the classification system used for organ donation.”

**DCD technique protocol**

According to Italian law (29 December 1993 n.578, and the decree of the Italian Minister of Health 11 April 2008), various criteria determine when death can be declared and organ retrieval can begin. This includes 20 minutes of asystole. A patient’s suitability for organ donation is assessed based on their medical and social history, clinical status, clinical examination, and laboratory test results. After 20 minutes of continuous asystole resulting in cardiac death, Normothermic Reperfusion (NrP) was established by cannulating the femoral artery and vein. A Fogarty catheter was then placed into the contralateral femoral artery after systemic donor heparinization. The catheter was inflated at the level occlusion of the supraceliac aorta to exclude the supradiaphragmatic circle. The cannulas were connected through an extracorporeal circuit (ECMO, extracorporeal membrane oxygenator) (Getinge®, Goteborg Sweden)), and were that was composed of a centrifugal pump, an oxygenator and a heat-cooler exchanger. Regional perfusion was performed under normothermic conditions (37 °C) using autologous donor blood. NrP has been performed in combination with the CytoSorb® cartridge (Aferetica, Italy). The CytoSorb cartridge was connected in parallel with the main ECMO circuit (cartridge blood inlet in the positive pressure post-oxygenator, cartridge blood outlet in negative pressure pre-pump).

The withdrawal of treatment was delayed until the procurement and retrieval team had made their necessary preparations in the ICU. Meanwhile, the perfusion unit, which consisted of different members than those involved in the decision-making process around the withdrawal of treatment, was notified by phone. When systolic pressure started to fall below 100 mmHg, the perfusion unit prepared for organ recovery and subsequent retrieval procurement. The ICU’s team was previously trained to manage vascular access, the aortic balloon and arterial/venous cannula positioning. The presence of a technical perfusionist allowed ECMO procedures to be conducted under normothermic conditions for regional perfusion and subsequent organ recovery.

**Karpinski’s score**

This histologic score evaluates chronic lesions in each compartment of the renal parenchyma, which is useful in assessing whether the kidneys are suitable for transplantation (single or double) or unsuitable.

The score involves a semi-quantitative analysis, assigning a score between 0 and 3 for the following morphological components:

- degree of glomerulosclerosis: the anatomic pathologist, to calculate the glomerular score, counts the total number of glomeruli, both healthy and sclerotic, present for each section in the prepared slide. He then calculates the score by evaluating the percentage of sclerotic glomeruli to the total.

- Tubular atrophy: this consists of primary damage to the renal tubules and interstitium that causes reduced kidney function. The pathologist’s task is to quantify the percentage of atrophic tubules compared to the total number.

- Interstitial fibrosis: the pathologist quantifies the increase in fibrous connective tissue in the cortical parenchyma, which is indicative of tissue scarring. The extension of interstitial fibrosis indicates the severity of chronic kidney disease.

- Vascular sclerosis with narrowing of the lumen: the pathologist measures the thickness of the vessel by comparing it with the diameter of the lumen. Increased vascular wall thickness is an indicator of hyaline atherosclerosis, a characteristic lesion in the kidneys of donors with hypertension.

Two slides are prepared for each biopsy: one stained with PAS to assess glomeruli, tubules, and vessels, and the other stained with Masson’s trichrome to assess the degree of interstitial fibrosis. The sum of the four scores yields an overall kidney score, which can have a value from 0 (no renal lesions) to 12 (indicating the presence of marked changes in renal parenchyma), based on which the suitability for transplantation is defined. Kidneys with a score of 7 or above are not eligible for either single or double transplantation and are discarded.

# Results

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Supplementary Fig. 1. Right kidney Karpinski score correlation with organ suitable for transplantation plot.



Supplementary Fig. 2. Left kidney Karpinski score correlation with organ suitable for transplantation plot.



Supplementary Fig. 3. Postestimation univariate logistic analysis: on Y axis the probability to be suitable for transplantation, on the X axis the lactate values before the beginning of NrP.



Supplementary Fig. 4. Postestimation univariate logistic analysis: on Y axis the probability to be suitable for transplantation, on the X axis Age (years) of DCD donors.

Supplementary Table 1. Lactate mixed model preliminary analysis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lactate | Coef. | St.Err. | *t*-value | *p*-value | (95% Conf Interval) | Sig |
| Constant | 10.032 | 0.463 | 21.65 | <0.001 | 9.124–10.94 | \*\*\* |
| Constant | 1.383 | 0.082 | .b | .b | 1.231–1.554 |  |
| Mean dependent var | 10.032 | | SD dependent var | | 4.014 |  |
| Number of obs | 74 | | Akaike crit. (AIC) | | 418.692 |  |

*\*\*\*p* < 0.01, St.Err.: standard error; Conf Interval: confidence interval. var: variable; SD: standard deviation; obs: observations.

Supplementary Table 2. Lactate mixed model for time and organs suitable for transplantation.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Lactate | Coef. | St.Err. | *t*-value | *p*-value | (95% Conf Interval) | Sig |
| Time | −0.013 | 0.005 | −2.86 | 0.004 | −0.022–−0.004 | \*\*\* |
| Outcome | −3.051 | 1.070 | −2.85 | 0.004 | −5.149–−0.953 | \*\*\* |
| Constant | 13.891 | 1.075 | 12.92 | <0.001 | 11.783–15.999 | \*\*\* |
| Constant | 1.283 | 0.082 | .b | .b | 1.131–1.454 |  |
| Mean dependent var | 10.032 | | SD dependent var | | 4.014 |  |
| Number of obs | 74 | | Chi-square | | 16.439 |  |
| Prob > chi2 | 0.000 | | Akaike crit. (AIC) | | 407.846 |  |

\*\*\**p* < 0.01, St.Err.: standard error; Conf Interval: confidence interval. var: variable; SD: standard deviation; obs: observations.