

NEW ROLE FOR PERFUSIONISTS

F. Zanella, CCP

*Servizio di Fisiopatologia Cardiocircolatoria
Azienda Ospedaliera di Padova*

AZIENDA OSPEDALIERA DI PADOVA



4 ECMO PROGRAMS

398 ECMO 2011-2015 (739 ECMO 1986-2015)

60%
CA
CARDIAC ADULTS

20%
RA
RESPIRATORY ADULTS

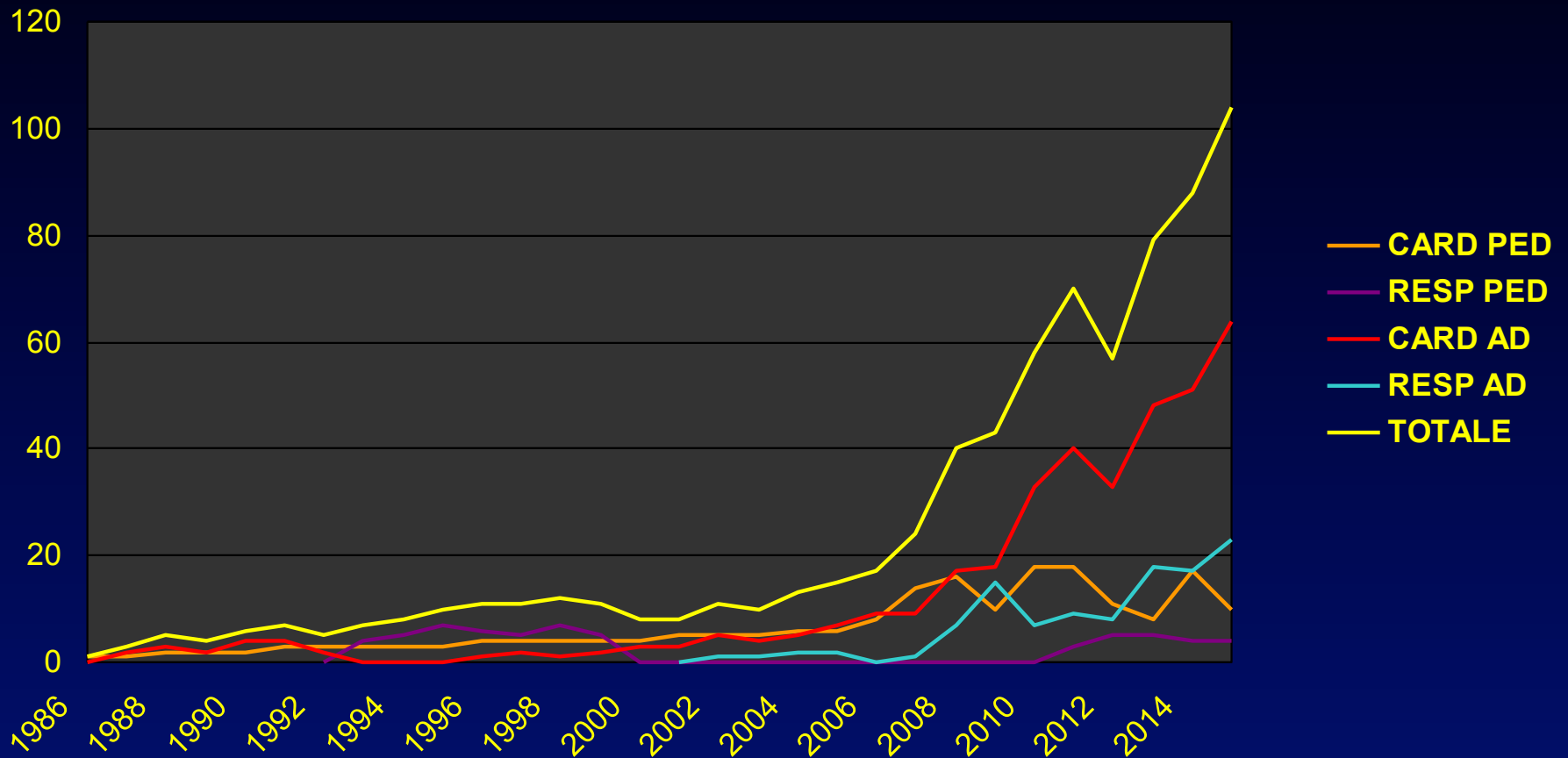
V-A 90 %	V-V 10 %
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15%
CP
CARDIAC PEDIATRICS

5%
RP
RESPIRATORY PEDIATRICS

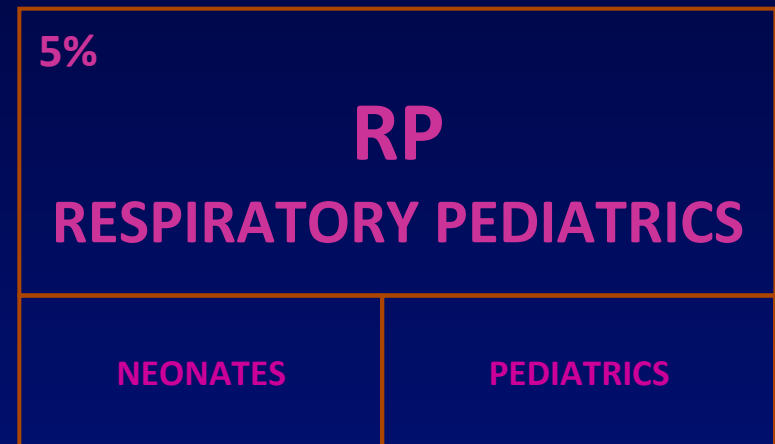
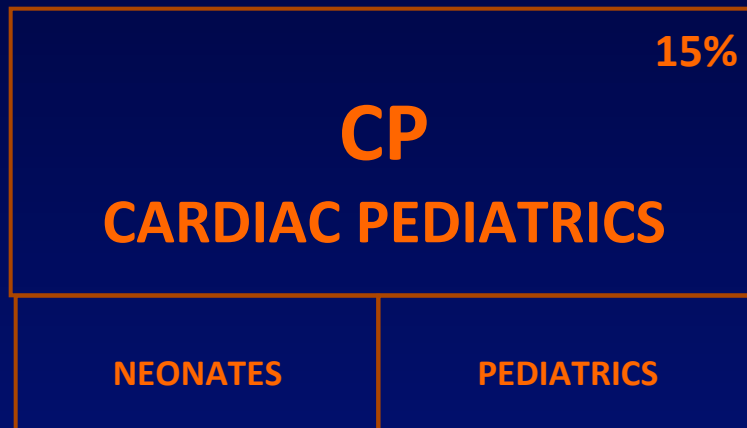
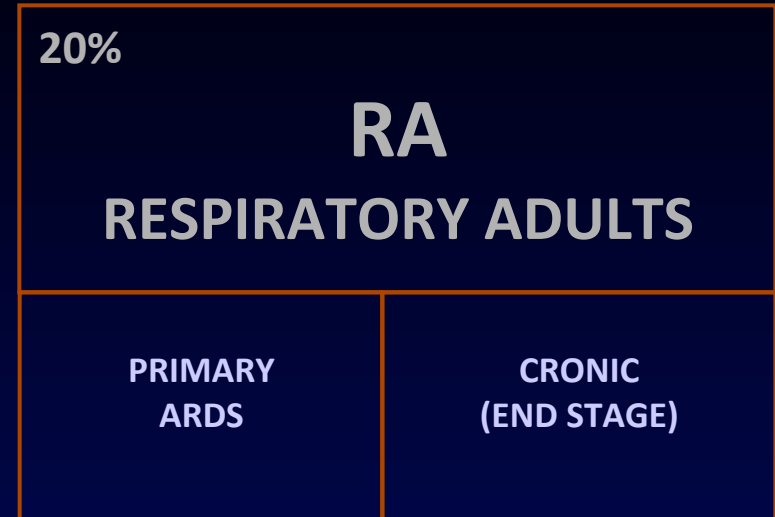
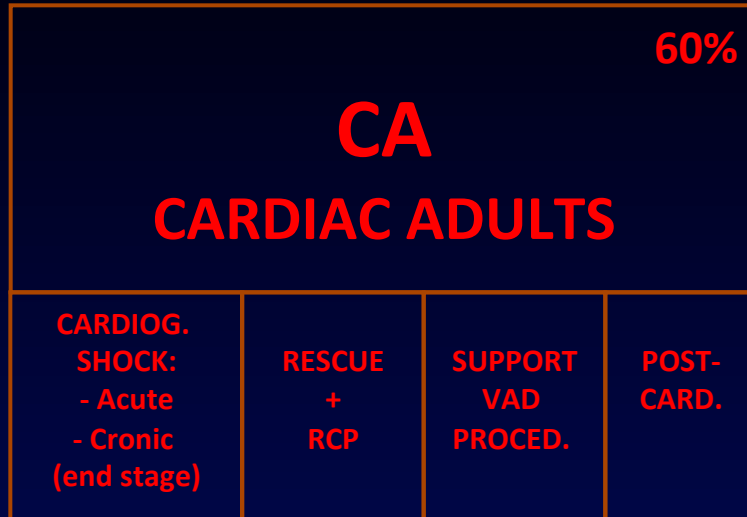
TREND ECMO 1986 – 2015

Azienda Ospedaliera di Padova

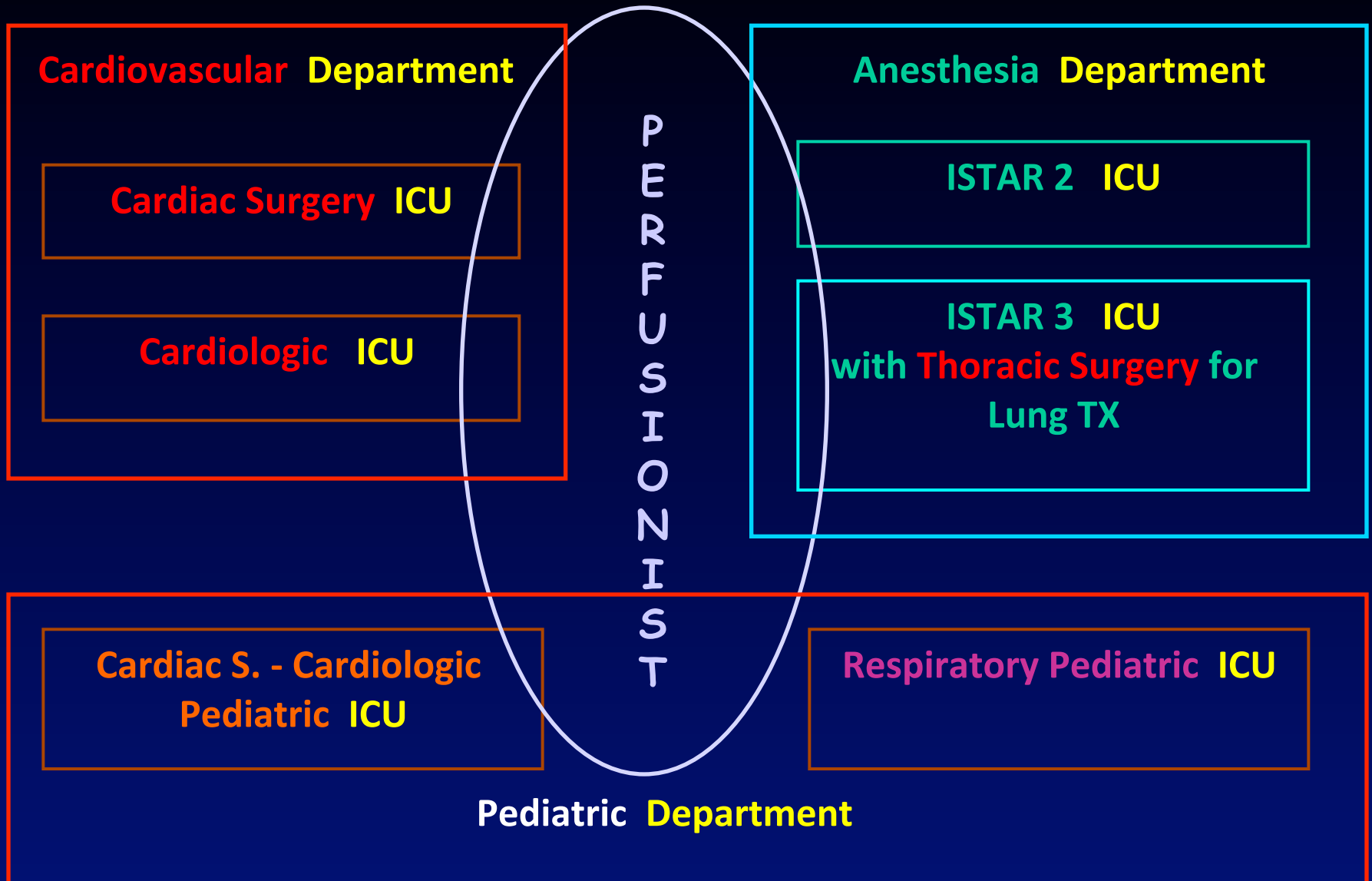


4 ECMO PROGRAMS

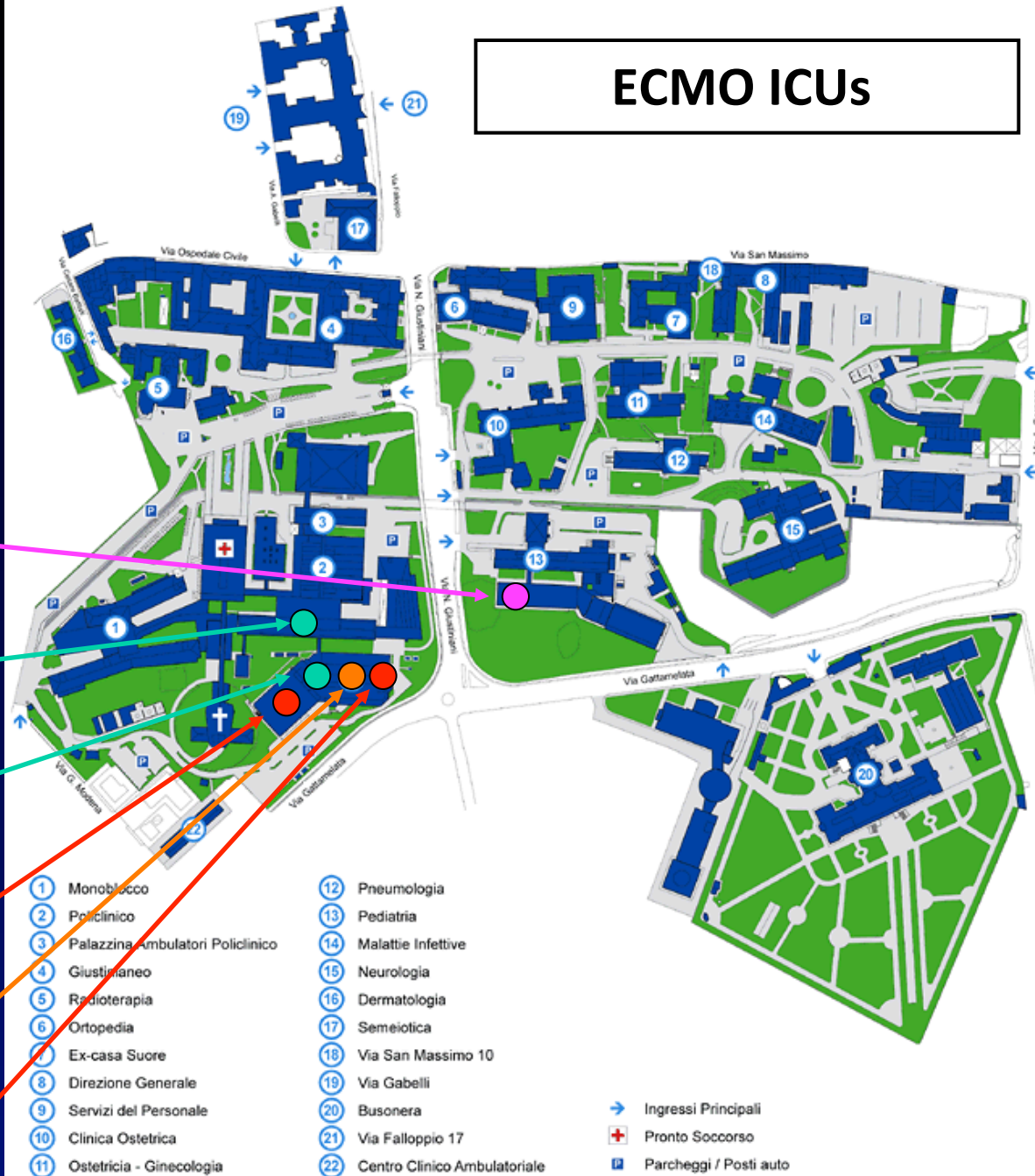
397 ECMO 2011-2015 (738 ECMO 1986-2015)



6 ICU in 3 Departments



ECMO ICUs



Respiratory Pediatric ICU

ISTAR 2 ICU

ISTAR 3 ICU

Cardiologic ICU

Pediatric CS – Cardiologic ICU

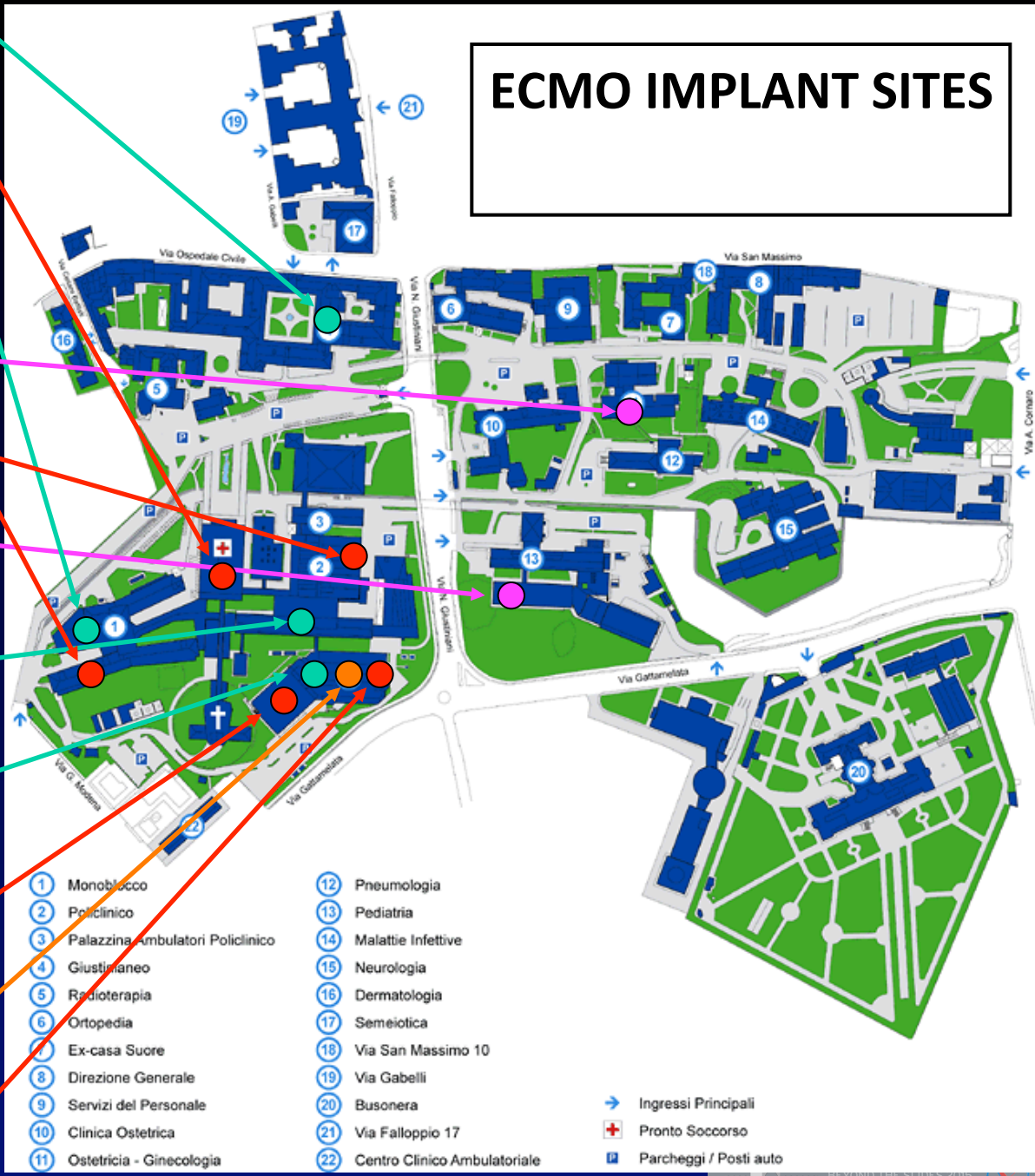
Cardiac Surgery ICU

- | | |
|------------------------------------|--------------------------------|
| ① Monoblocco | ⑫ Pneumologia |
| ② Policlinico | ⑬ Pediatria |
| ③ Palazzina Ambulatori Policlinico | ⑭ Malattie Infettive |
| ④ Giustiniano | ⑮ Neurologia |
| ⑤ Radioterapia | ⑯ Dermatologia |
| ⑥ Ortopedia | ⑰ Semeiotica |
| ⑦ Ex-casa Suore | ⑱ Via San Massimo 10 |
| ⑧ Direzione Generale | ⑲ Via Gabelli |
| ⑨ Servizi del Personale | ⑳ Busonera |
| ⑩ Clinica Ostetrica | ㉑ Via Falloppio 17 |
| ⑪ Ostetricia - Ginecologia | ㉒ Centro Clinico Ambulatoriale |

- ➔ Ingressi Principali
- ⊕ Pronto Soccorso
- P Parcheggio / Posti auto

ECMO IMPLANT SITES

- ISTAR 1 ICU**
- First Aid E.R.**
- Central ICU**
- Neonatal ICU**
- Other O.R.s**
- Respiratory Pediatric ICU**
- ISTAR 2 ICU**
- ISTAR 3 ICU**
- Cardiologic ICU**
- Pediatric CS – Cardiologic ICU**
- Cardiac Surgery ICU**




- | | |
|------------------------------------|--------------------------------|
| ① Monoblocco | ⑫ Pneumologia |
| ② Policlinico | ⑬ Pediatria |
| ③ Palazzina Ambulatori Policlinico | ⑭ Malattie Infettive |
| ④ Giustiniano | ⑮ Neurologia |
| ⑤ Radioterapia | ⑯ Dermatologia |
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- ➔ Ingressi Principali
- ⊕ Pronto Soccorso
- P Parcheggio / Posti auto

ECMO MAP

Data: 7/12/2015

Backup Adulto	Backup Pediatrico	ECMO TAVI
Luogo preciso: <u>S.O. 4</u>	Luogo preciso: <u>SP. 3</u>	Luogo preciso: <u>S.O. 2</u>
Pompa: <u>PLS</u>	Pompa: <u>SCP</u>	Pompa: <u>BIOPUMP</u>
Oxy: <u>QUADROX</u>	Oxy: <u>LILLIPUT</u>	Oxy: <u>EOS</u>
<input type="checkbox"/> Asciutto <input checked="" type="checkbox"/> Riempito	<input type="checkbox"/> Asciutto <input checked="" type="checkbox"/> Riempito	<input type="checkbox"/> Asciutto <input checked="" type="checkbox"/> Riempito
Montato il: <u>2.12.2015</u>	Montato il: <u>21.11.2015</u>	Montato il: <u>18.11.2015</u>
Riempito il: <u>2.12.2015</u>	Riempito il: <u>21.11.2015</u>	Riempito il: <u>18.11.2015</u>

ECMO O VAD	ECMO O VAD	ECMO O VAD
Paziente: <u>[redacted]</u>	Paziente: <u>[redacted]</u>	Paziente: <u>[redacted]</u>
T.I.: <u>ISTAR 2</u>	T.I.: <u>TIPED</u>	T.I.: <u>TIPO CCH</u>
Pompa: <u>PLS</u>	Pompa: <u>SCP</u>	Pompa: <u>LEVITRONIX</u>
Oxy: <u>QUADROX</u>	Oxy: <u>LILLIPUT</u>	Oxy: <u>/</u>
Data inizio: <u>2.12.2015</u>	Data inizio: <u>3.12.2015</u>	Data inizio: <u>3.12.2015</u>
Tipo: <input type="checkbox"/> VA <input checked="" type="checkbox"/> VV <input type="checkbox"/> VAD/BIVAD	Tipo: <input type="checkbox"/> VA <input checked="" type="checkbox"/> VV <input type="checkbox"/> VAD/BIVAD	Tipo: <input type="checkbox"/> VA <input type="checkbox"/> VV <input checked="" type="checkbox"/> VAD/BIVAD ^{dx}
Note: <u>INFETTO</u> 	Note: <u>AVALON 10Fr</u>	Note: <u>S/p IMPIANTO JARVIK</u>

ECMO O VAD	ECMO O VAD	ECMO O VAD
Paziente: <u>[redacted]</u>	Paziente: <u>[redacted]</u>	Paziente: <u>[redacted]</u>
T.I.: <u>UCIC</u>	T.I.: <u>TIPO CCH</u>	T.I.: <u>ISTAR 3</u>
Pompa: <u>PLS</u>	Pompa: <u>PLS / LEVITRONIX</u>	Pompa: <u>PLS</u>
Oxy: <u>QUADROX</u>	Oxy: <u>QUADROX / 1</u>	Oxy: <u>QUADROX PED</u>
Data inizio: <u>4.12.2015</u>	Data inizio: <u>5.12.2015</u>	Data inizio: <u>5.12.2015</u>
Tipo: <input checked="" type="checkbox"/> VA <input type="checkbox"/> VV <input type="checkbox"/> VAD/BIVAD	Tipo: <input type="checkbox"/> VA <input type="checkbox"/> VV <input checked="" type="checkbox"/> VAD/BIVAD	Tipo: <input checked="" type="checkbox"/> VA <input type="checkbox"/> VV <input type="checkbox"/> VAD/BIVAD
Note: <u>CWH CONNESSA</u>	Note: <u>HUB-SPOKE</u>	Note: <u></u>
<u>all'ECMO</u>		

HUB & SPOKE PROGRAM



ECMO TEAM:

1 Cardiac Surgeon

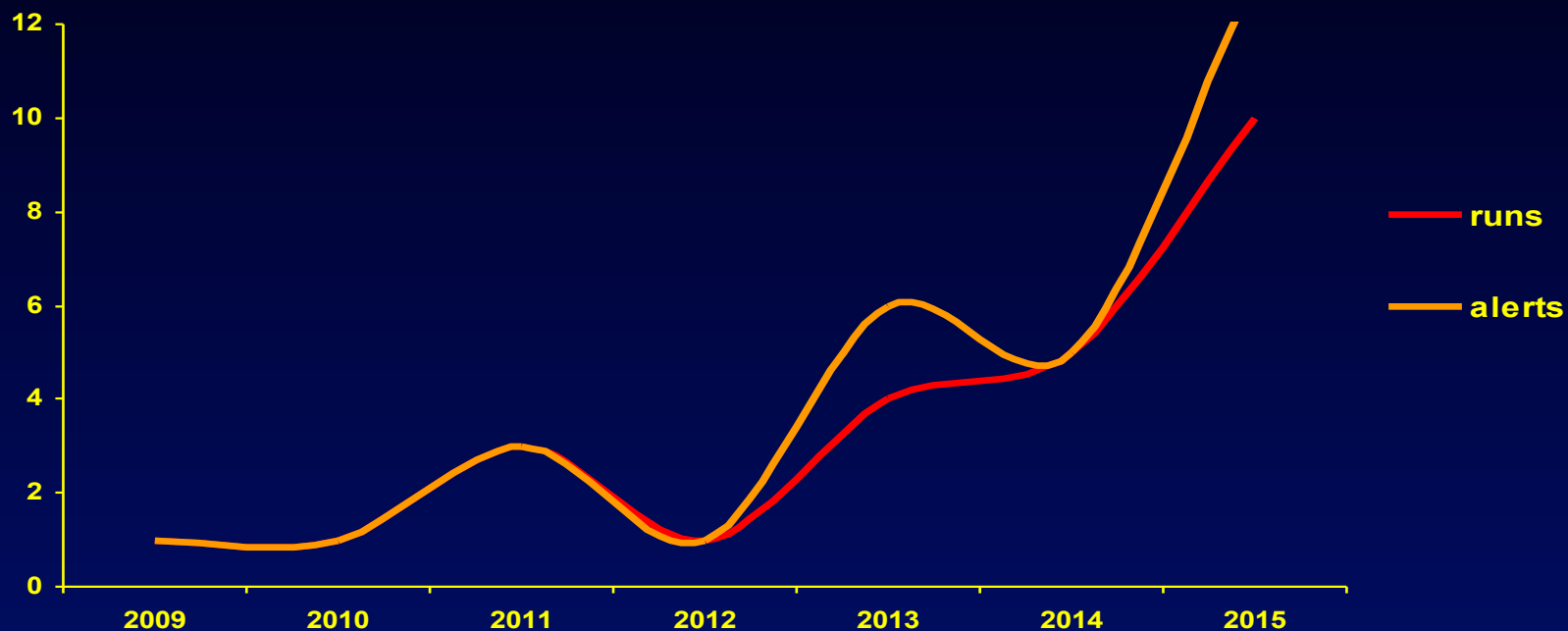
1 Anesthetist

1 Perfusionist

+ 1 (Cardiac Surgeon or Anesthetist) depends on pathology

Ready to go in 15 min. if in hosp., 45 min. if on call.

RUNS & ALERTS HUB&SPOKE TEAM 2009 – 2015



HUB & SPOKE ALERT



SURGICAL BAG (optional)



DISPOSABLE BAGS



HARDWARE BAG

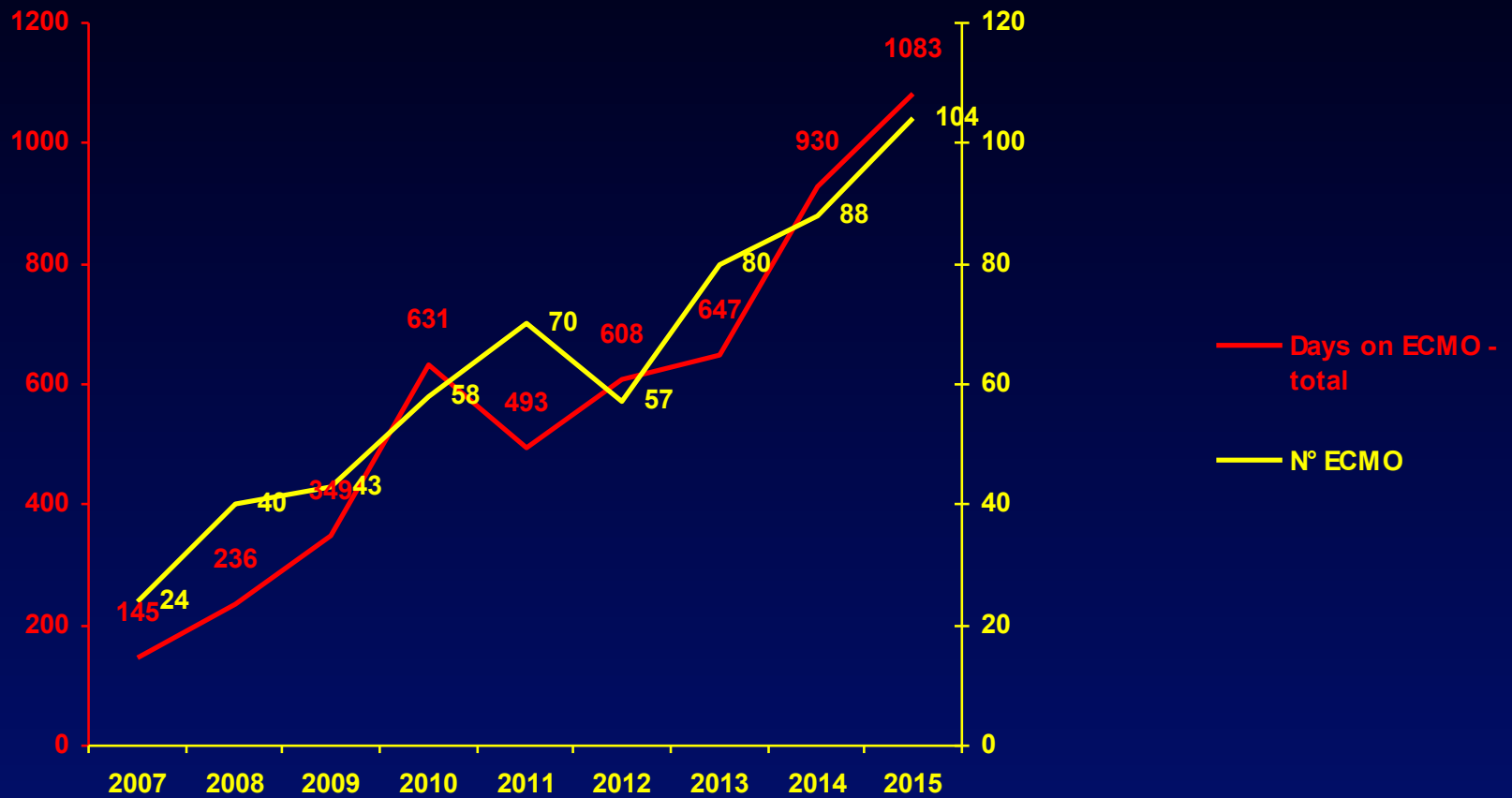
DEDICATED
AMBULANCE



Console, Driver & Handcrank
Back-up sterile kit
Rack
Monitor
Syringe pumps
IABP (optional)



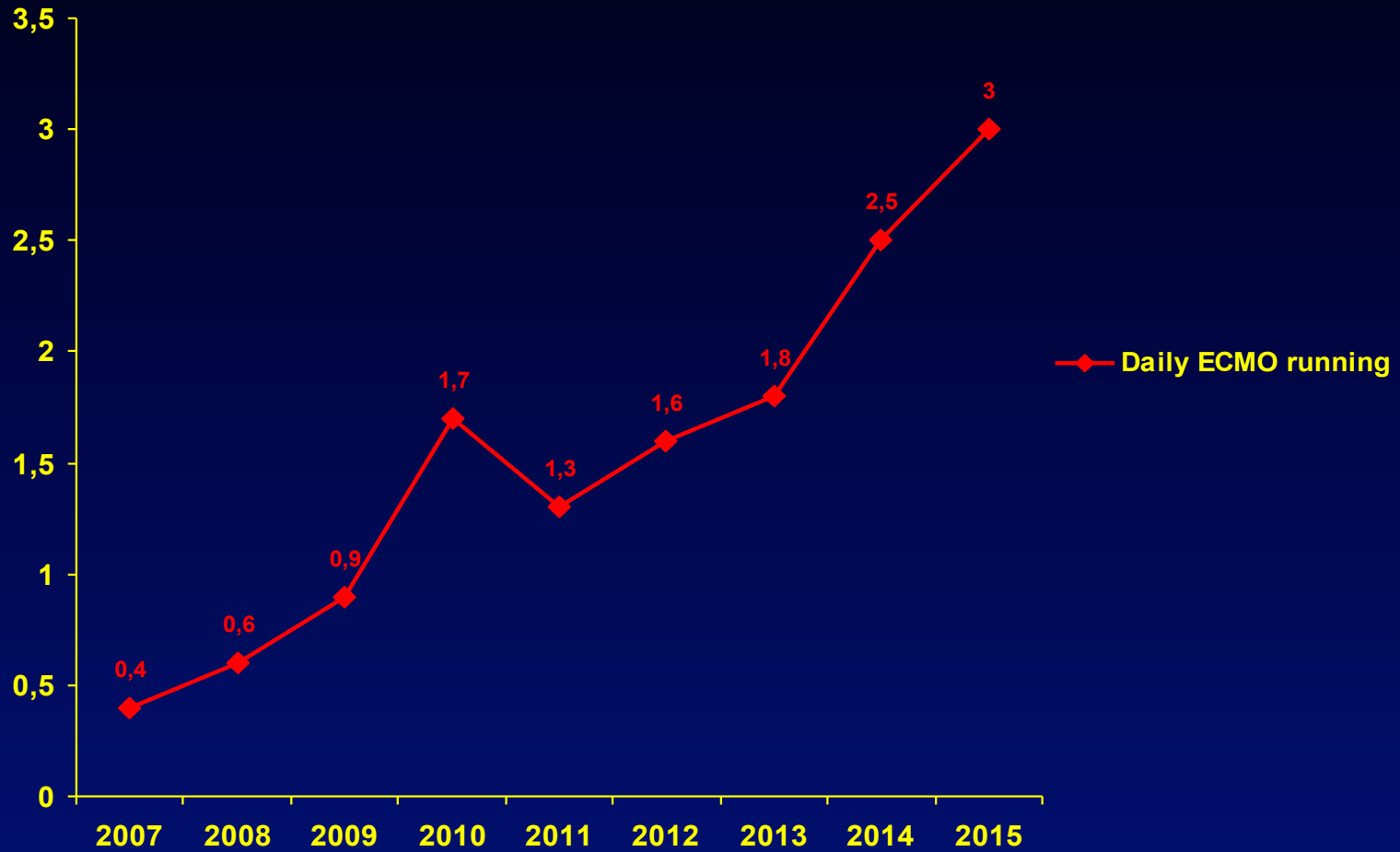
Total Days on ECMO



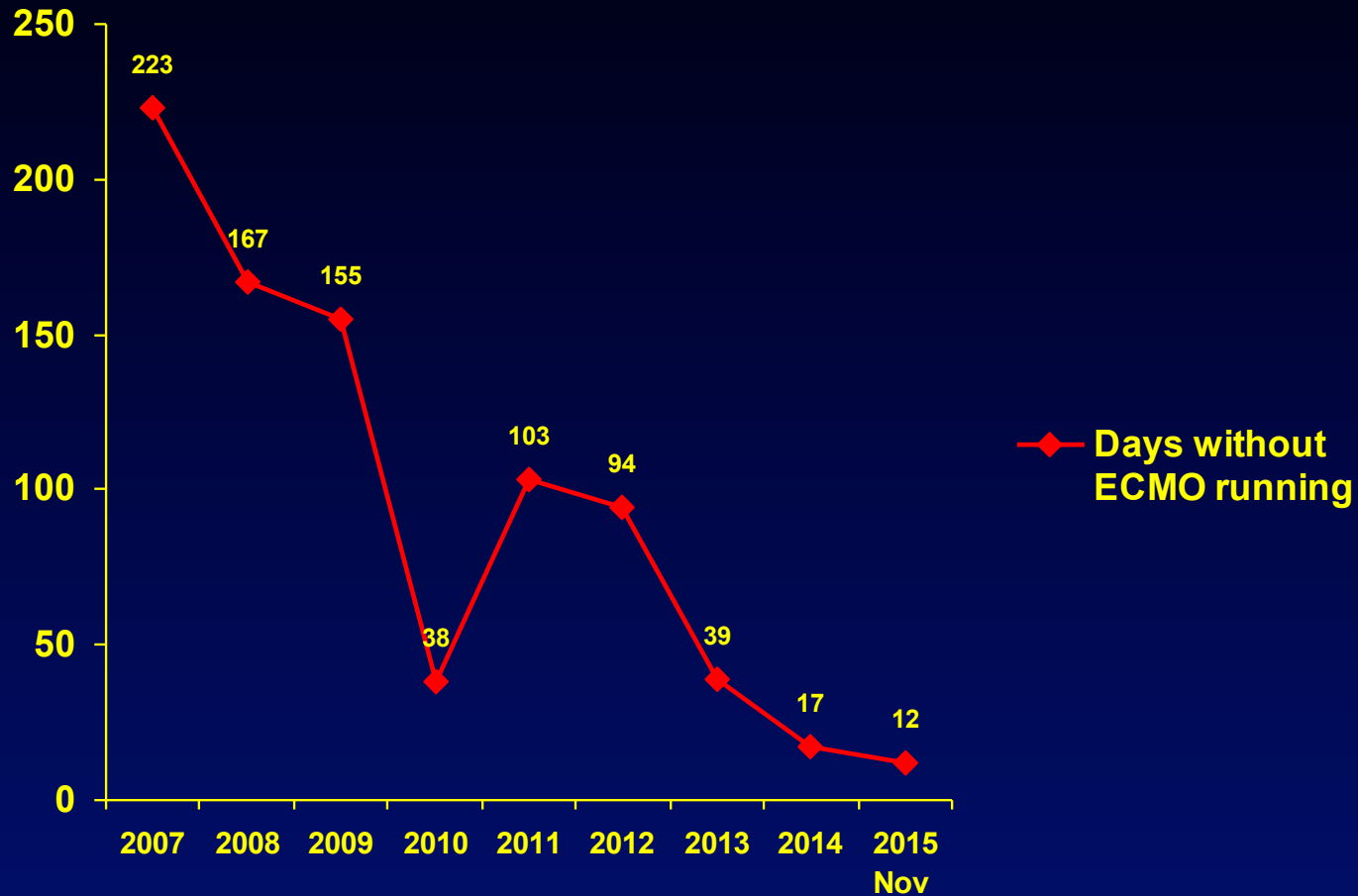
Average duration



Daily ECMO patients



Days without ECMO patients



PERFUSIONIST MANAGEMENT:

ON-DUTY **MON – FRI** **7,00 - 20,00**

ON-CALL **NIGHTS – SAT – SUN**

PLANNED ROUNDS **EVERYDAY**

SOME NIGHTS ON-DUTY IN AGREEMENT WITH PHYSICIAN
(instable patients, multiple (6-9) patients, weaning phases, ...)

Extra-corporeal life support following cardiac surgery in children: analysis of risk factors and survival in a single institution[☆]

Bahaaldin Alsofi^{a,*}, Osman O. Al-Radi^b, Colleen Gruenwald^b, Lynn Lean^b, William G. Williams^b, Brian W. McCrindle^b, Christopher A. Caldarone^b, Glen S. Van Arsdell^b

^a King Faisal Heart Institute, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

^b Labatt Family Heart Center, Hospital for Sick Children and the University of Toronto, Toronto, Ontario, Canada

Wet-priming extracorporeal membrane oxygenation device maintains sterility for up to 35 days of follow-up

F Naso, A Gandaglia, P Balboni, F Zanella, R Danesin, M Spina and G Gerosa

Perfusion published online 7 December 2012

DOI: 10.1177/0267659112469641

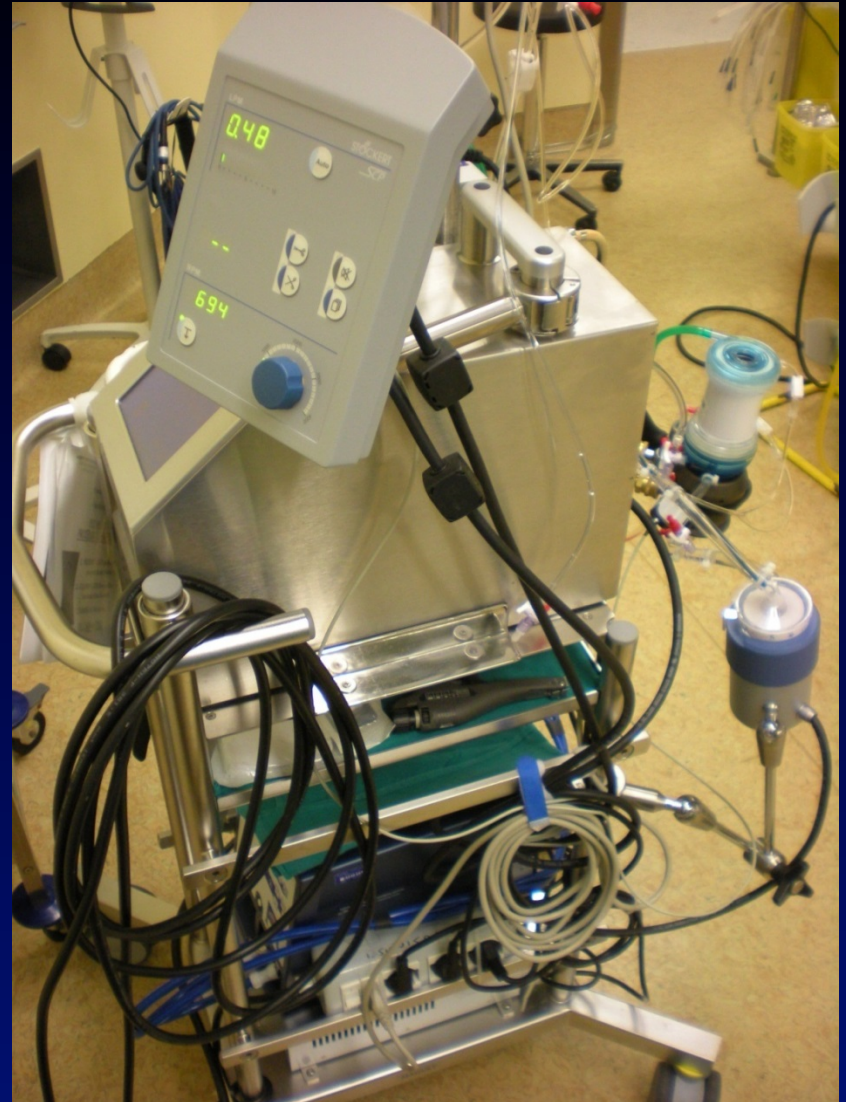
3 PRIMED CIRCUITS



13 CENTRIFUGAL CONSOLES









TERAPIA INTENSIVA	DATA / /	Paziente
ETICHETTA PAZIENTE	Data Inizio Assistenza / /	<input type="checkbox"/> VERIFICA DELLE 24 ORE <input type="checkbox"/> VERIFICA DI FINE-TRASPORTO
	N° controllo progressivo N° _____	ORA: _____ FIRMA: _____



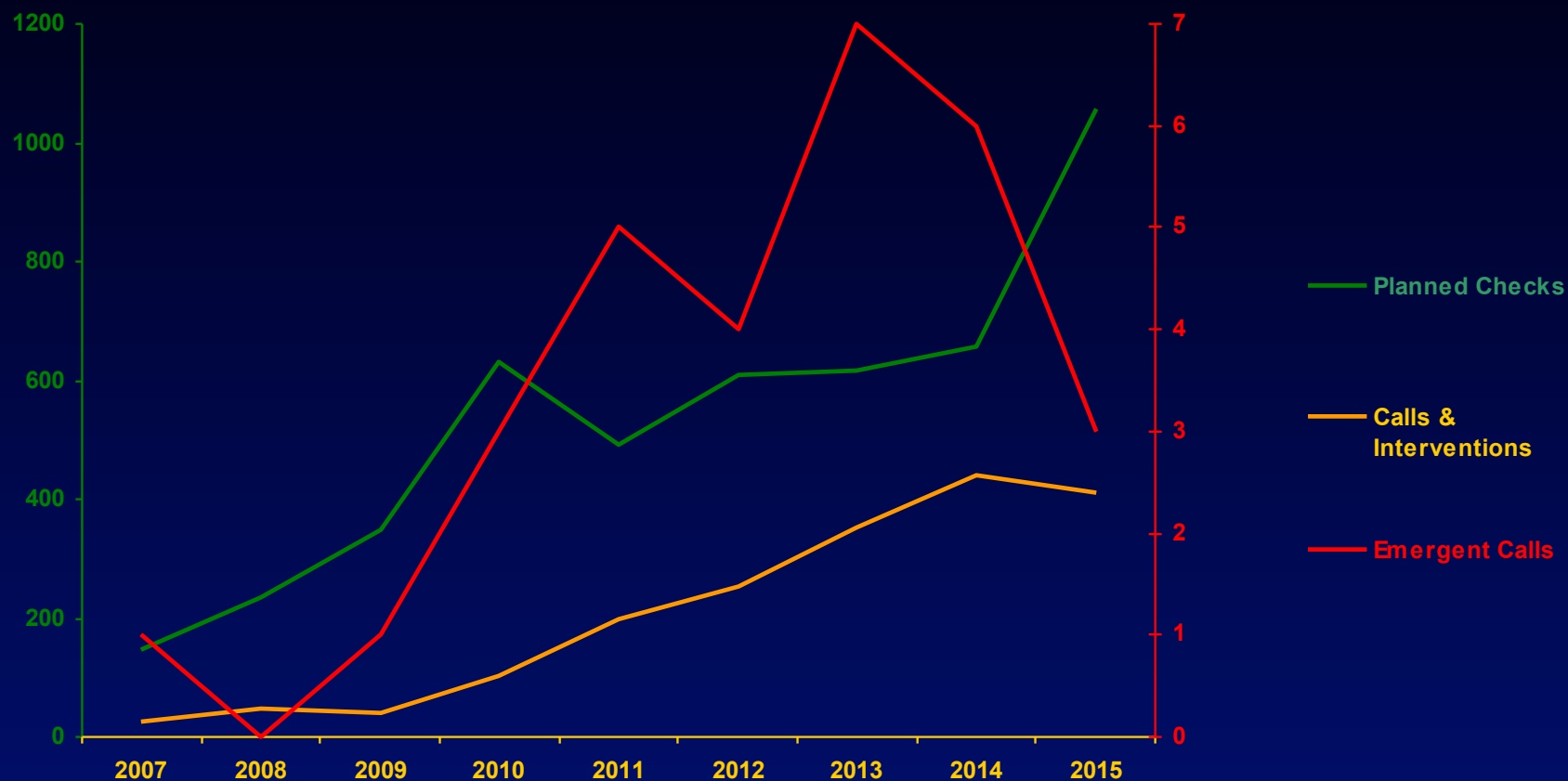
PERFUSIONIST MONITORING PROTOCOLS:

DAILY CHECKLIST

OK	CHECKLIST VERIFICA	OK	CHECKLIST VERIFICA
<input type="checkbox"/>	Confronto con MdG ed Infermiere stato paziente	<input type="checkbox"/>	Analisi trend parametri ultime 24 ore
<input type="checkbox"/>	Assenza messaggi allarme	<input type="checkbox"/>	Verifica presenza di aria nel circuito
<input type="checkbox"/>	Presenza e corretto posizionamento manovella	<input type="checkbox"/>	Verifica fissaggio tappini, rubinetti e connessioni
<input type="checkbox"/>	Test distacco alimentazione, verifica test batteria	<input type="checkbox"/>	Verifica integrità del circuito ed accessori connessi
<input type="checkbox"/>	Corretto posizionamento e fissaggio motore	<input type="checkbox"/>	Ispezione con fonte luminosa assenza coaguli
<input type="checkbox"/>	Ispezione motore (assenza surriscaldamento)	<input type="checkbox"/>	Corretta posizione tubi (assenza kinking e trazioni)
<input type="checkbox"/>	Connessioni regolari rete elettrica e gas medicali	<input type="checkbox"/>	Allarme di flusso minimo impostato a: _____
<input type="checkbox"/>	Bombola Ossigeno Takeo carica > 300 lt.	<input type="checkbox"/>	Test allarme flusso minimo - Test zero flusso
<input type="checkbox"/>	Presenza schede di emergenza (istruzioni manovella, clamp, bombola takeo)	<input type="checkbox"/>	Ispezione e auscultazione pompa centrifuga (assenza vibrazioni anomale)
<input type="checkbox"/>	Presenza clamp di emergenza (catenella)	<input type="checkbox"/>	Corretto funzionamento emofiltro (pediatrico)
<input type="checkbox"/>	Presenza tubetto crema ultrasonica	<input type="checkbox"/>	Corretto funzionamento riscaldatore
<input type="checkbox"/>	Presenza turni reperibilità (sede diversa TICCH)	<input type="checkbox"/>	Livello acqua riscaldatore regolare
<input type="checkbox"/>	Presenza ECMO di BACK-UP	<input type="checkbox"/>	Verifica pulizia carrello, circuito e rimozione polvere
<input type="checkbox"/>	Presenza 2 confezioni sterili di "cera per ossa"	<input type="checkbox"/>	Carrello ben posizionato con ruote bloccate
<input type="checkbox"/>	Flush Gas 10 lt (5 lt x ped.) x spurgo condensa	<input type="checkbox"/>	

Note ed eventi da segnalare : _____

Perfusionist Checks & Calls



“URGENT” CALLS

1,85 → 1,72

for every ECMO



“EMERGENT” CALLS

1 every 18 ECMO



1 every 34 ECMO



ISTRUZIONE OPERATIVA

**Posizionamento e gestione ECMO
per insufficienza respiratoria
nel paziente adulto**

ISTRUZIONE OPERATIVA

**Posizionamento e gestione ECMO
per shock cardiogeno
nel paziente adulto**

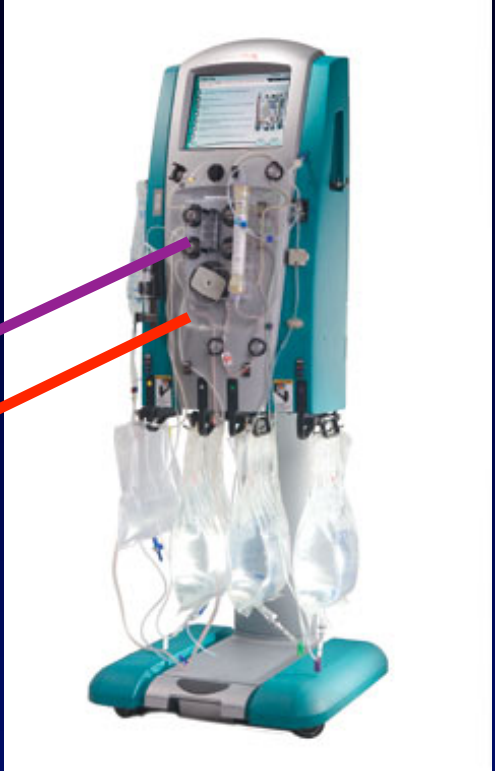
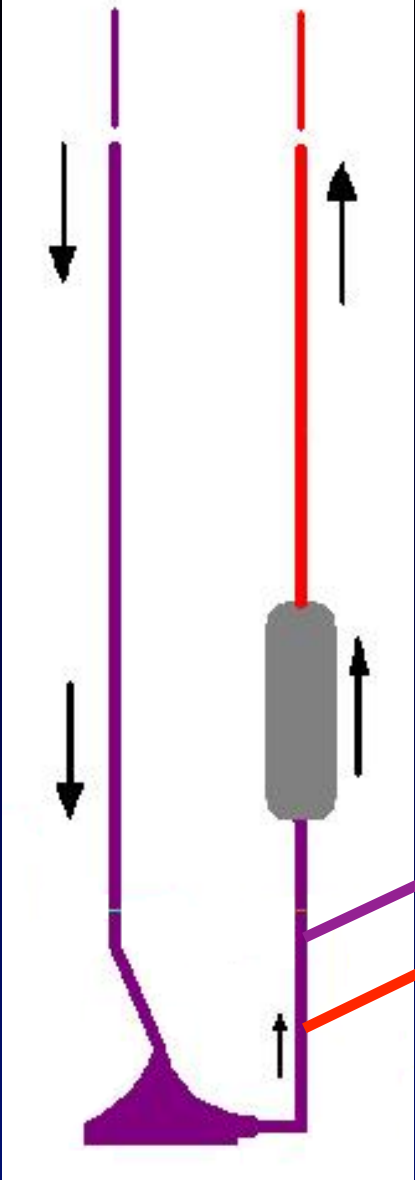
Gruppo di lavoro

Cognome Nome	Profilo professionale	Unità Operativa
Baratto Fabio	Medico Anestesista	U.O.C. Istituto Anestesia e Rianimazione
Battanolli Paola	Infermiere Coordinatore	ISTAR II Istituto Anestesia e Rianimazione
Bianco Roberto	Medico Cardiocirurgo	U.O.C. Cardiocirurgia
Bonaccorso Giuseppina	Medico Anestesista	U.O.C. Anestesia e Rianimazione
Bordignon Greta	Medico Igiene e Medicina Preventiva	Direzione Medica Ospedaliera
Cacciavillani Luisa	Medico Cardiologo	U.O.C. Cardiologia UCIC
Cacco Rosaria	Infermiere Magistrale	DMO Rischio Clinico e Sicurezza del Paziente
Castoro Massimo	Medico Igiene e Medicina Preventiva	Unità Valutazione Technology Assessment UVTA
Daniele Elisa	Infermiere Magistrale	S.C. Qualità e Accreditamento
Favero Valter	Infermiere Coordinatore	TIPO Cardiocirurgia e Cl. Chirurgica
Feltracco Paolo	Medico Anestesista	U.O.C. Istituto Anestesia e Rianimazione
Pettenello Lucia	Infermiere Coordinatore	Servizio per le Professioni Sanitarie
Persona Paolo	Medico Anestesista	U.O.C. Istituto Anestesia e Rianimazione
Pittarello Demetrio	Medico Anestesista	U.O.C. Istituto Anestesia Rianimazione
Rampazzo Roberta	Infermiere Coordinatore	U.O.C. Anestesia e Rianimazione
Rossi Sandra	Medico Anestesista	U.O.C. Istituto Anestesia Rianimazione
Soldà Lorenzo	Infermiere Coordinatore	ISTAR I Istituto Anestesia e Rianimazione
Zanella Fabio	TFCPC Coordinatore	Servizio Fisiopatologia Cardiocircolatoria – PO1C
Zoletto Marta	Tecnico di Laboratorio Magistrale	Servizio per le Professioni Sanitarie

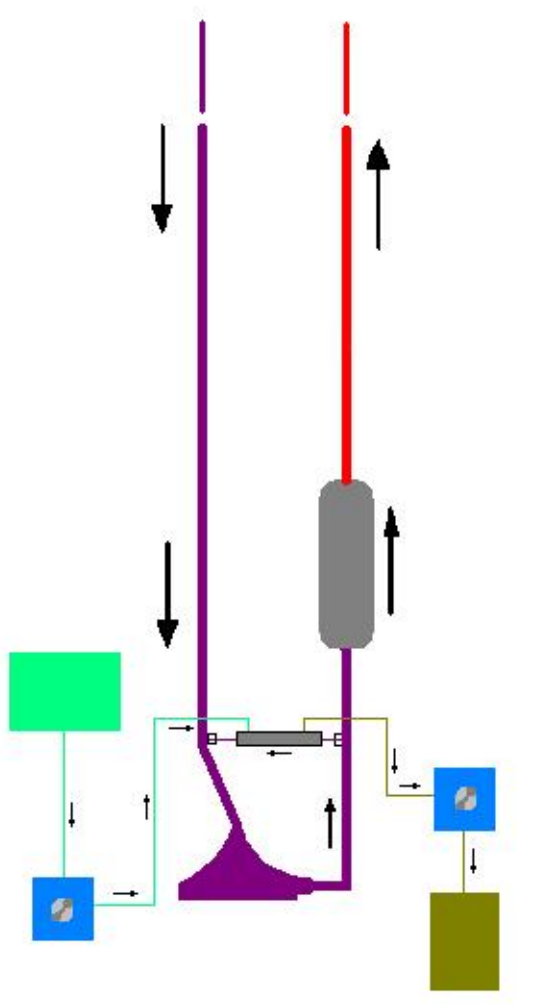
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Cacciavillani Luisa	Medico Cardiologo	U.O.C. Cardiologia UTIC
Cacco Rosaria	Infermiere Magistrale	Rischio Clinico e Sicurezza del Paziente DMO
Castoro Massimo	Medico Igiene e Medicina Preventiva	Unità Valutazione Technology Assessment UVTA
Da Corte Giovanni	Infermiere	U.O.C. Cardiologia UTIC
Daniele Elisa	Infermiere Magistrale	S.C. Qualità e Accreditamento
Favero Valter	Infermiere Coordinatore	TIPO Cardiocirurgia e Cl. Chirurgica
Gasparetto Nicola	Medico Cardiologo	U.O.C. Cardiologia UTIC
Maritan Mauro	Infermiere	TIPO Cardiocirurgia
Magoga Francesca	Infermiere	U.O.C. Cardiologia UTIC
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Pugiotto Fabio	Infermiere	U.O.C. Cardiocirurgia
Rossi Sandra	Medico Anestesista	U.O.C. Istituto Anestesia Rianimazione
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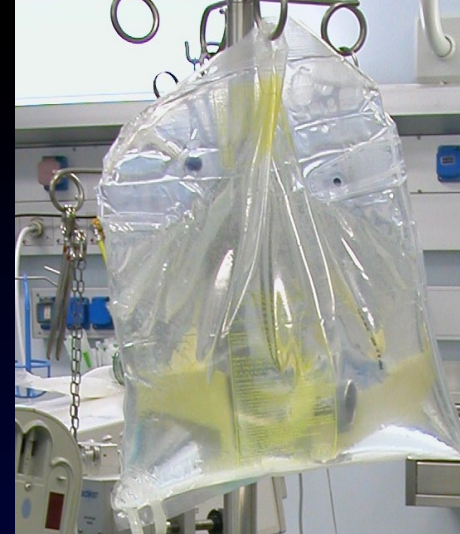
POSITIVE PRESSURE BEFORE OXYG.



Continuous Micro HemoDiaFiltration on ECMO



Hollow fiber: >600 micron
Dialitic IN-flow: 200 ml/h
Filtrated OUT-flow: 200 ± 30 ml/h



Extracorporeal membrane oxygenation: The simplified weaning bridge

Vladimiro L. Vida, MD, PhD, Mauro Lo Rito, MD, Massimo A. Padalino, MD, PhD, and Giovanni Stellin, MD, Padua, Italy

Extracorporeal membrane oxygenation (ECMO) is commonly used in children to allow recovery from post-cardiac surgical heart failure that is refractory to medical therapy or resuscitation. The overall survival after ECMO has been reported to be between 35% and 51% in institutions where a dedicated 24-hour in-house ECMO team is part of the surgical program.¹⁻⁴ In pediatric cardiac centers with average volumes, however, a specialized ECMO team is often not available and a greater effort must be made to provide the best outcome for patients requiring mechanical circulatory support.

We describe an easy and reproducible technical solution for weaning patients from ECMO support. This method proved to be a safe and an effective solution in our institution, where a dedicated 24-hour in-house ECMO team is lacking.

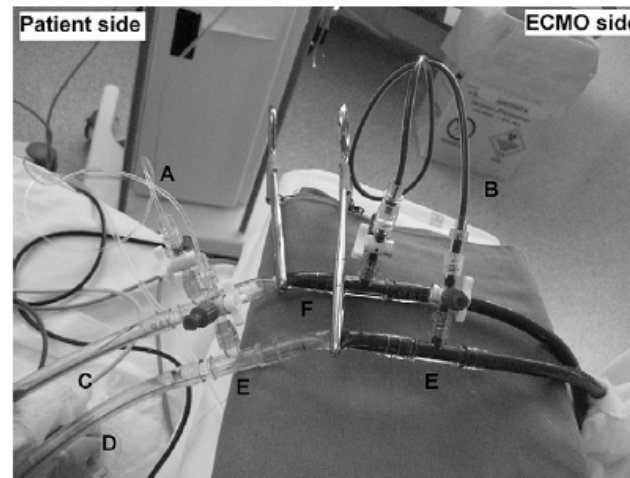
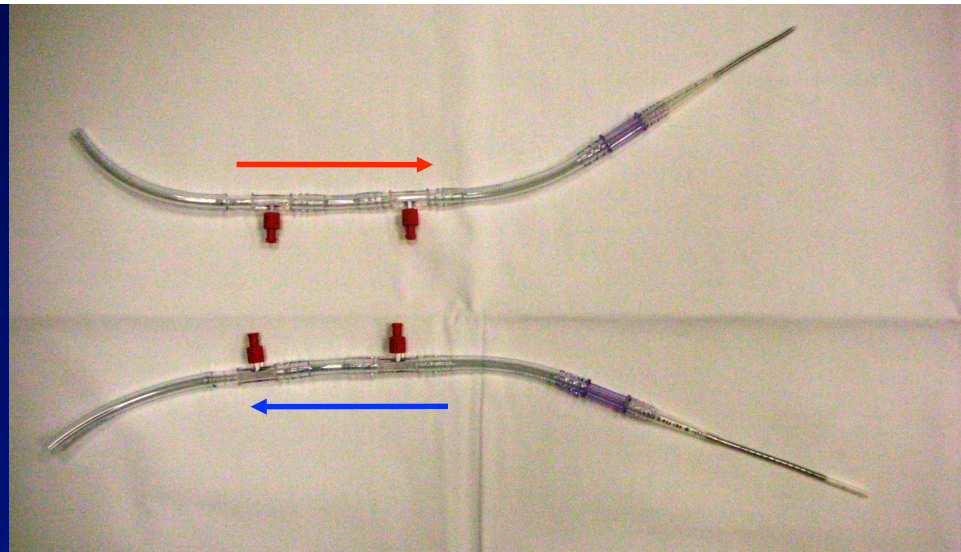
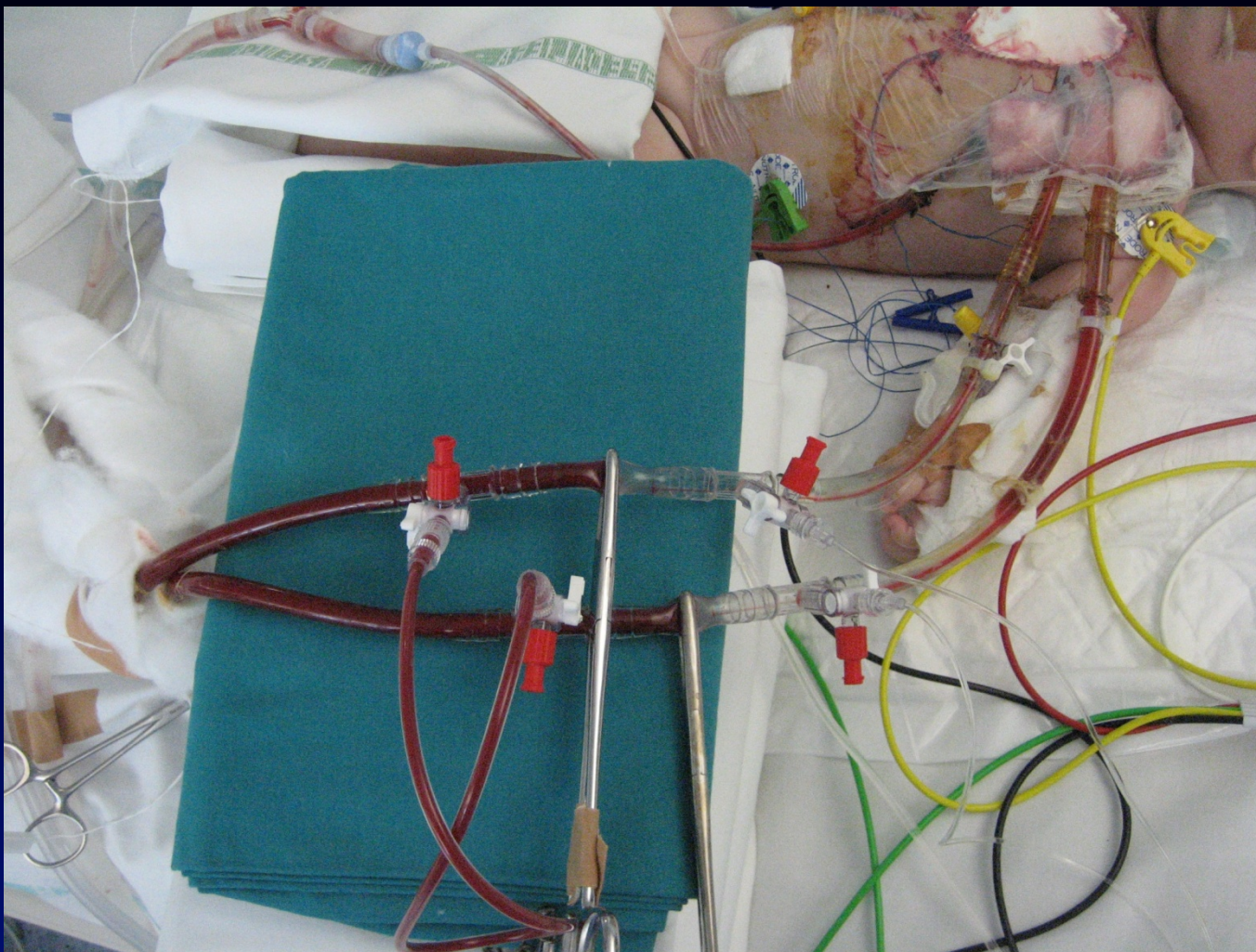


FIGURE 1. The simplified weaning bridge: (A) heparin infusion lines; (B)



SIMPLIFIED WEANING BRIDGE



Managing the extracorporeal membrane oxygenation (ECMO) circuit integrity and safety utilizing the perfusionist as the “ECMO Specialist”

Perfusion

28(6) 552–554

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prf.sagepub.com



LB Mongero, JR Beck and KA Charette

Abstract

Extracorporeal membrane oxygenation (ECMO) is an extracorporeal technique of providing both cardiac and respiratory support to patients whose heart and lungs are so severely diseased or damaged that they can no longer serve their function. Neonatal and pediatric ECMO was accepted as practice in the early 1990s and according to the Extracorporeal Life Support Organization, ELSO; of the >50,000 patients registered, 73% have survived extracorporeal life support (ECLS). It is not uncommon to find initial cannulation of a patient receiving ECMO performed by a surgeon and then the maintenance of the patient being left in the hands of various others deemed as the “ECMO Specialists”. The specialist has a broad base of professionals, including: nurses, respiratory therapists, perfusionists and physicians. Each institution, having its own unique training for these individuals, has provided a milieu for education, but does not share an established standard of care. From 2009, after the surge of the H₁N₁ epidemic, adult ECMO has been increasing; n=53 in 2010 to n=110 in 2012 at our institution. The perfusionist has been the “specialist” for ECMO at our institution since the early 1990s and remained at bedside during ECMO. We have now developed a safe circuit and fiscally responsible staffing model that utilizes a perfusionist and a telemetry-based electronic record keeper, permitting the perfusionist to leave the bedside and interact with the circuit when necessary. This has permitted an expansive growth of ECMO in our intensive care units at our facility incorporating a multidisciplinary collaboration system wide.

Discussion

ECMO is cardiopulmonary bypass; perfusionists are uniquely qualified to perform this task. Historically, it may have been a matter of necessity that respiratory therapists and nurses were trained to manage ECMO as there were not enough perfusionists to meet the demand. In some instances, it may have been that perfusionists were not interested in embracing the technology since it was out of the operating room and not under the jurisdiction of the cardiac surgeon.⁶ Regardless of the staffing guidelines employed, it is important to understand that the expertise required to manage critically ill ECMO patients is not benign. Additionally, providing increments of advanced training, competency review and simulation education to nurses and respiratory therapists who are not perfusionists is time consuming. Every effort should be made to utilize the perfusionist as an "ECMO specialist" since they practice these techniques every day. The perfusion team in our hospital is available for many procedures that require the use of extracorporeal circulation and are available 24 hours per day. The rigors of component change-out and troubleshooting are second nature to the perfusionist and, although it may seem reasonable to select familiar equipment specific for ECMO, such as a centrifugal pump as mentioned in Freeman et al.,⁵ the truth is that there may always be variations in the equipment used and the perfusionist is the most capable ECMO specialist. Owing to the fact that this institution did 33 adult ECMO in 2009 and then 110 in 2012 without the addition of perfusion staff correlates well with our hypothesis that rounding in the ICU every 2-4 hours enables cross-coverage of ECMO

cases and other cases performed by the perfusionist. It is important to note that an adequate perfusion staff must incorporate the ability to continue without interruption all the original responsibilities of the perfusion staff. It will be easier in the larger perfusion practice to incorporate new procedures, such as ECMO, without additional resources. This is one of the reasons the perfusionist had to defer to other allied professionals for managing ECMO support when it was first described by Bartlett et al. in the late 1970s.⁸ In addition, our institution has performed neonatal and pediatric ECMO since 1987 and our perfusionists have been sitting by the bedside during the entire run. This is the preference of the pediatric surgeon. It was not until 2009 and the H1N1 epidemic that adult ECMO impacted our practice and enabled this model for our adult patients. Our experience justifies the use of the perfusionist as the "ECMO specialist" and other team roles enhance the bedside care of the ECMO patient.

Perfusionist as ECMO specialist

The perfusionist has documented competency in every facet of extracorporeal circulation technology by virtue of their didactic and clinical training. Monitoring and safety device utilization are second nature to the perfusionist, whereas it would need to be taught and reviewed

periodically to non-perfusion staff. The perfusionist has a minimum of 18-24 months of circulatory physiology and clinical application technology as a novice and ECMO is part of this comprehensive training. Extracorporeal life support circuitry is complex and the perfusionist is the most capable personnel for troubleshooting techniques.

Outcomes of the first 30 cases of an adult extracorporeal membrane oxygenation program: strategies to manage the “learning curve” and implications for intensive care unit risk adjustment models

Daniel V Mullany, Taessa N Bull, William Hunt, Kiran Shekar, Bruce Thomson, John F Fraser and Marc Ziegenfuss

At the first presentation of the CESAR trial, Dr Heidi Dalton, Director of the ECMO program at the Children’s Hospital of Pittsburgh, Pennsylvania, United States, said “I think the fear that a lot of us have with ECMO is that there is a learning curve, and it is not something that hospitals can implement without preparation,” she said. “We need to focus on providing training and teach people how to deliver ECMO.”²³ Complex therapies may show evidence of a volume–outcome relationship, although this is also debated.²⁴

In this study, we aimed to review and discuss outcomes of the first 30 adult patients placed on ECMO at The Prince Charles Hospital (TPCH), Brisbane, Queensland, Australia, and the lessons learnt after the commencement of an adult ECMO program.

Results: The model of care was based heavily on that used at an experienced ECMO centre following Extracorporeal Life Support Organization guidelines. ECMO was established as an ICU-managed, multidisciplinary service with collaboration from other specialties using standardised policies and procedures, staff training and formal case review. A specific budget was allocated to training and education and a clinical perfusionist was present on site for the first 10 cases. Seventeen patients received venoarterial (VA) and 13 received venovenous (VV) ECMO. Median duration of ECMO was 7 days for VA and 15 days for VV ECMO. Median ICU stay was 22 days. Twenty patients were referred from 13 hospitals throughout Queensland. Hospital mortality was 47% for VA ECMO and 15% for VV ECMO. The unique features of this service are the use of a Levitronix CentriMag system as well as the Rotaflow system, and the use of extended daily haemodiafiltration using the Fresenius 4008s ARrT plus connected into the ECMO circuit. The clinical implications of conducting plasma exchange and sustained low-efficiency dialysis via direct ECMO circuit connection using the Fresenius ARrT machine, and using a second system for ECMO support, were notable challenges.

PERFUSIONIST AS ECMO-SPECIALIST

CONs:

- HIGHER SALARY COSTS (in some countries)
- LOW AVAILABILITY OF PERFUSIONISTS (in some countries)
- NO AVAILABILITY OF PERFUSIONISTS (in some hospitals)

PROs:

- NO NEED OF A LEARNING CURVE
- NO NEED OF DEDICATED EDUCATIONAL OR RE-TRAINING PROGRAMS
- VOLUME-RELATED TROUBLE-SHOOTING SKILLS
- CHEAPER IF LOW RATIO NURSE:PATIENTS 1:2, 1:3
- OPTIMIZED MANAGEMENT OF MULTIPLE PROGRAMS IN SAME HOSP.

WHAT PERFUSIONIST DO AS “ECMO-SPECIALIST”:

- CIRCUIT SET-UP, PRIME & START ECMO
- SWITCH ECMO – VAD/BIVAD
- MANAGEMENT OF CRRT CONNECTION & NEONATAL HEMODIAFILTRATION
- SETUP OF DEDICATED WEANING BRIDGE & MONITOR WEANING PHASES
- EVERY TRANSFER OR TRANSPORT INTRA-INTER HOSPITAL
- PLANNED CHECKLISTS & BRIEFING WITH PHYSICIAN & NURSE
- ACTIVE BEDSIDE EDUCATION

“NEW” ROLE OR BACK TO THE PAST ?