

# Neuroblastoma: A 20-Year Experience in a UK Regional Centre

Adeline Salim<sup>1</sup>, Dhanya Mullassery<sup>1</sup>, Barry Pizer<sup>2</sup>,  
Heather McDowell<sup>2</sup>, Paul Losty<sup>1</sup>

<sup>1</sup> Academic Paediatric Surgery, Division of Child Health,  
University of Liverpool, UK

<sup>2</sup> Department of Paediatric Oncology, Alder Hey Children's NHS Foundation Trust,  
Liverpool



THE WOLFSON FOUNDATION



The Royal College of Surgeons of England

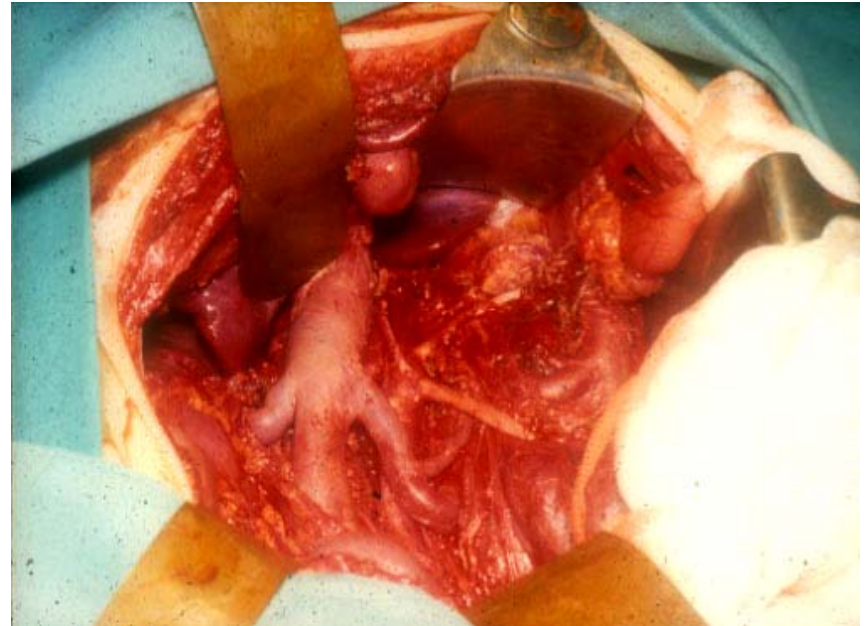
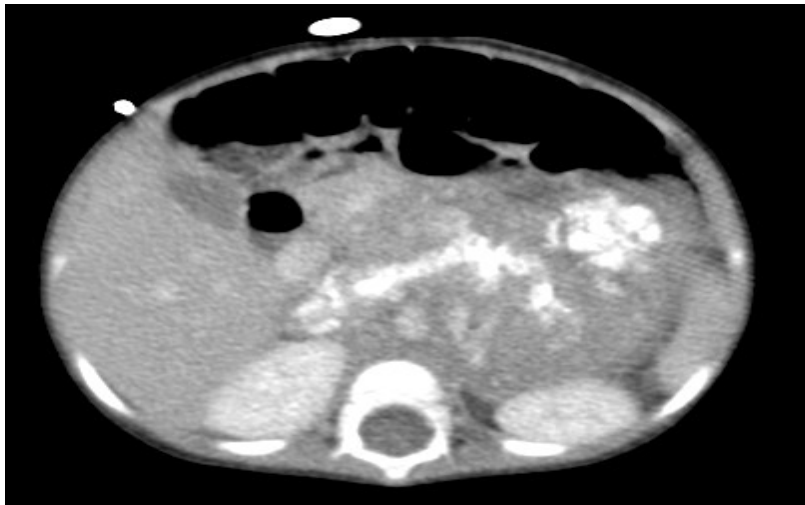


UNIVERSITY OF  
LIVERPOOL

# Neuroblastoma

## Challenge for paediatric surgeons

- **Commonest extracranial solid tumour**
- **Advanced disease >50% patients**
- **Newer therapies evolving**
- **Role of surgery ?**



# Methods

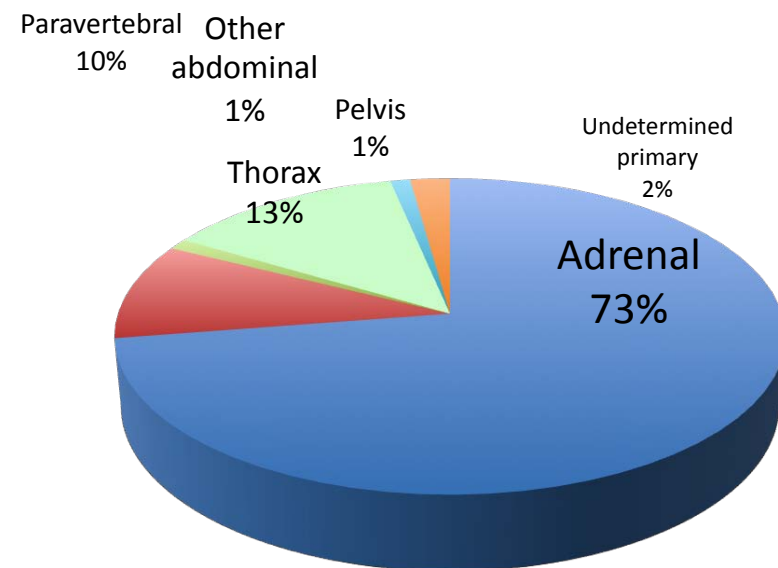
- UKCCLG centre  
Catchment 4.5 million
- Oncology database  
1985-2005
  - Hospital case records
  - Patient demographics
  - Operative notes



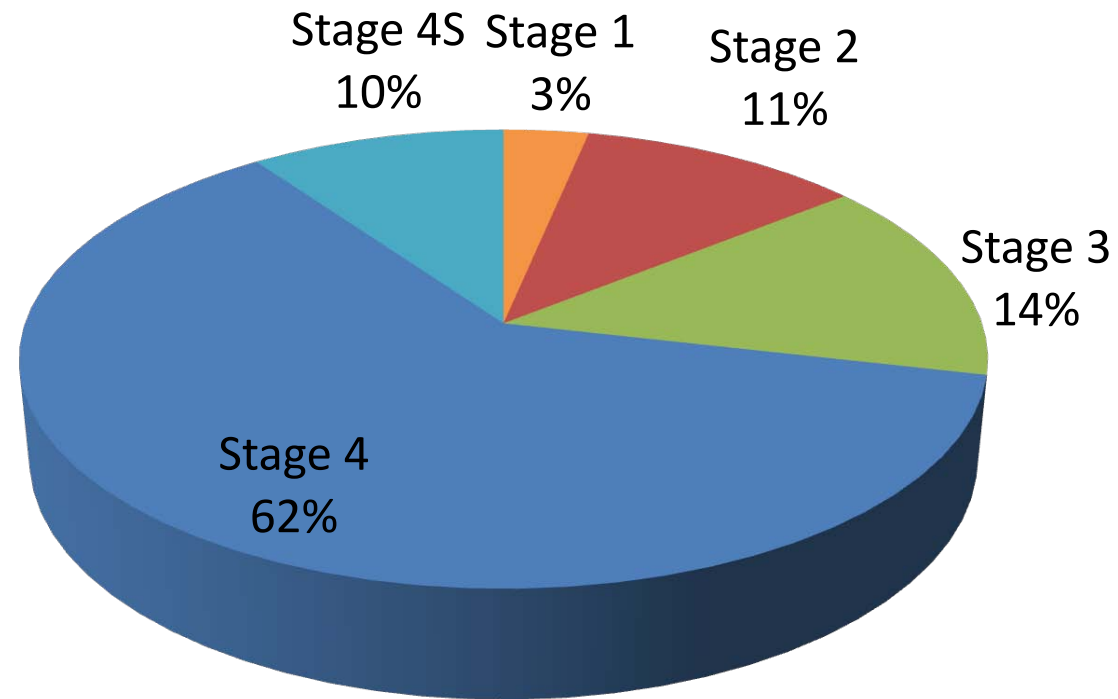
# Results

- 91 patients (M:F ratio 0.75:1)
- Median age at presentation 1.9 years (newborn – 14.9 years)
- Common presenting symptoms
- *MYCN* for stage 3 and 4:
  - Non-amplified 68.4%
  - Amplified 31.6%

## Site of primary tumour



# INSS Stage at diagnosis



# Surgery

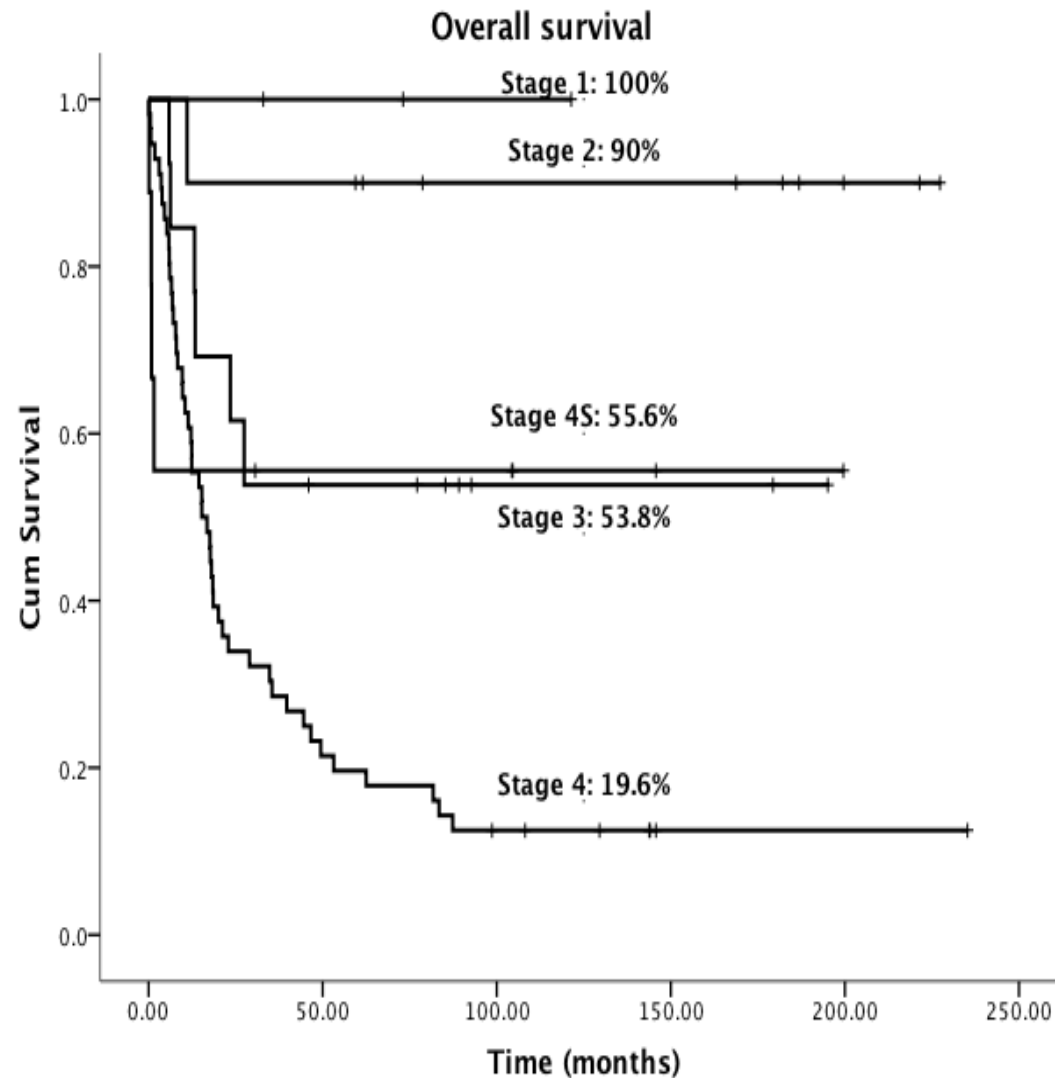


- Primary resection (stage 1 & 2)
  - 26%
- Delayed resection (stage 3 & 4)
  - 74%
- Reasons for non operation in stage 3 & 4:
  - Extensive disease (10)
  - Chemo-resistant tumours (10)
  - Complete remission after chemotherapy (2)
  - Early death (1)

# Morbidity

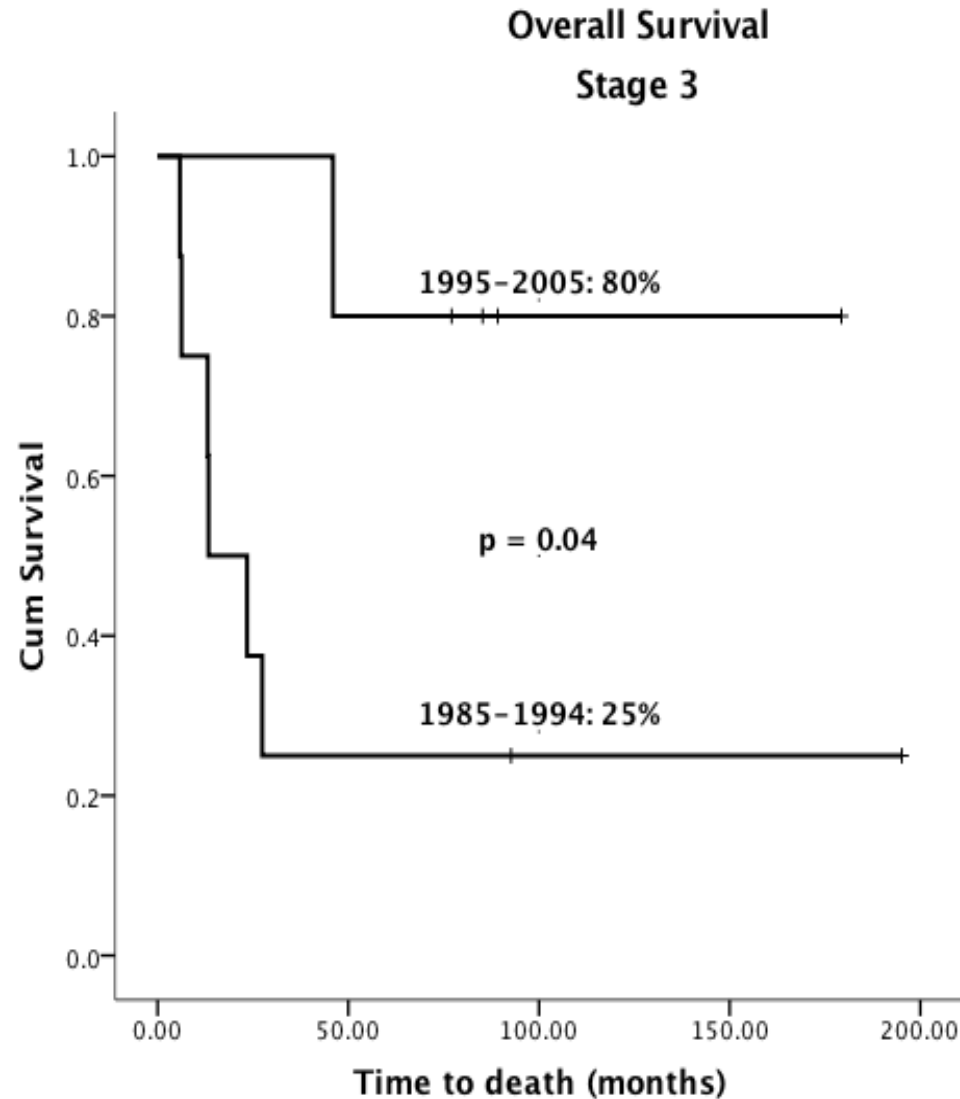
- **No operative deaths**
- Post-operative morbidity 13 (16%) patients
  - Nephrectomy (n=4)
  - Horner's syndrome (n=5)
  - Transient post-op diarrhoea, resolved within 24hrs
  - Intra-op haemorrhage (n=1)
  - Minor wound dehiscence (n=1)
  - 'Sympathectomised' peripheral extremity (n=1)

# 5-year overall survival by stage

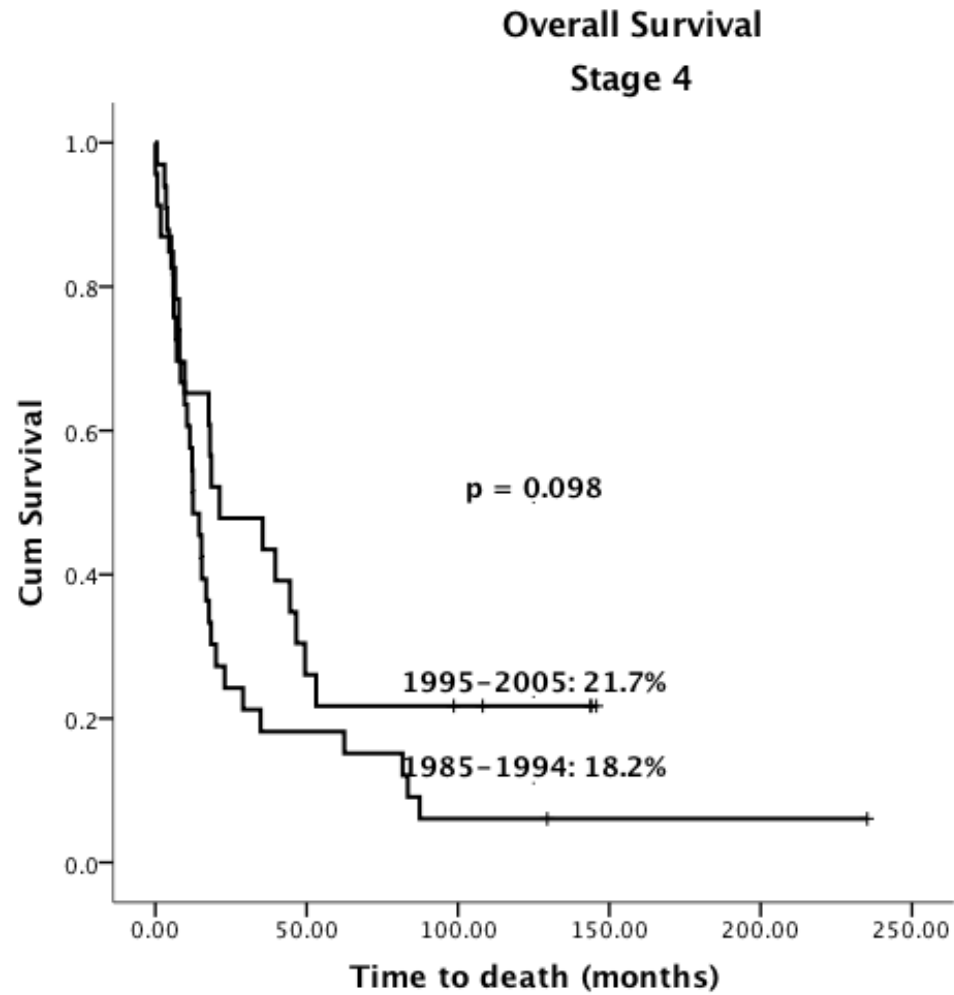




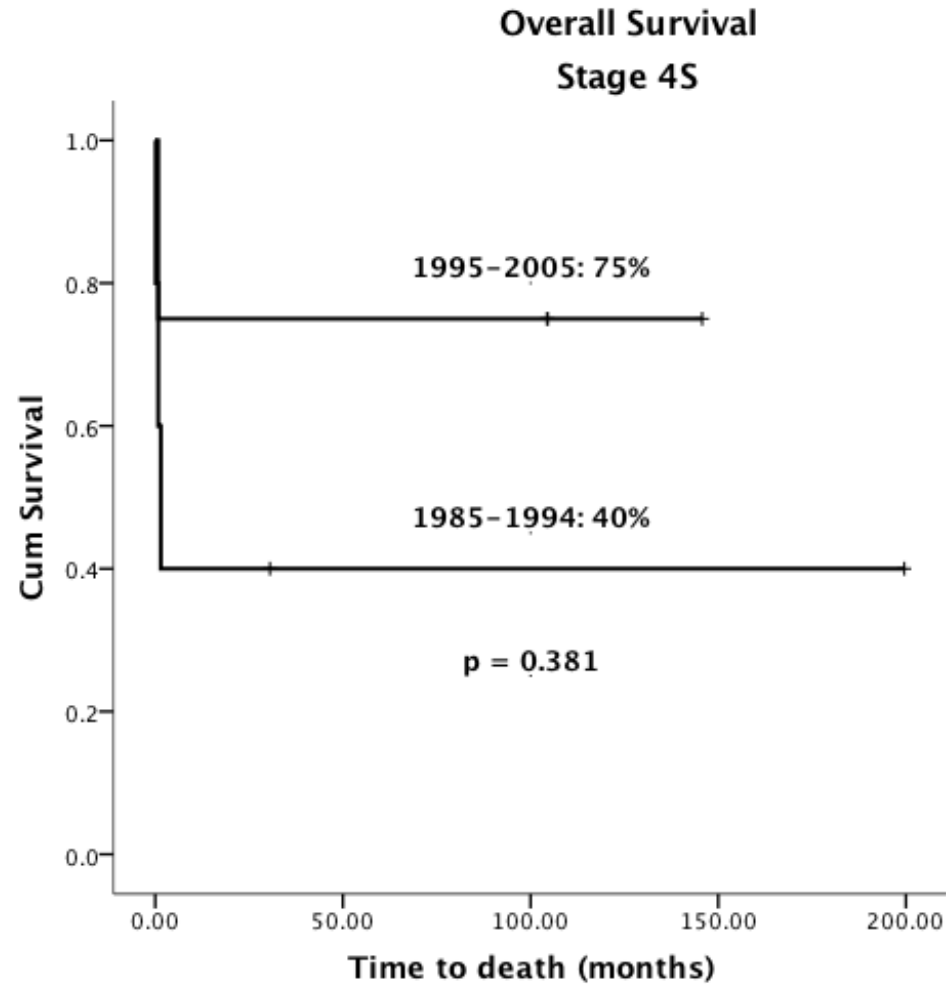
# 5-year overall survival by study era



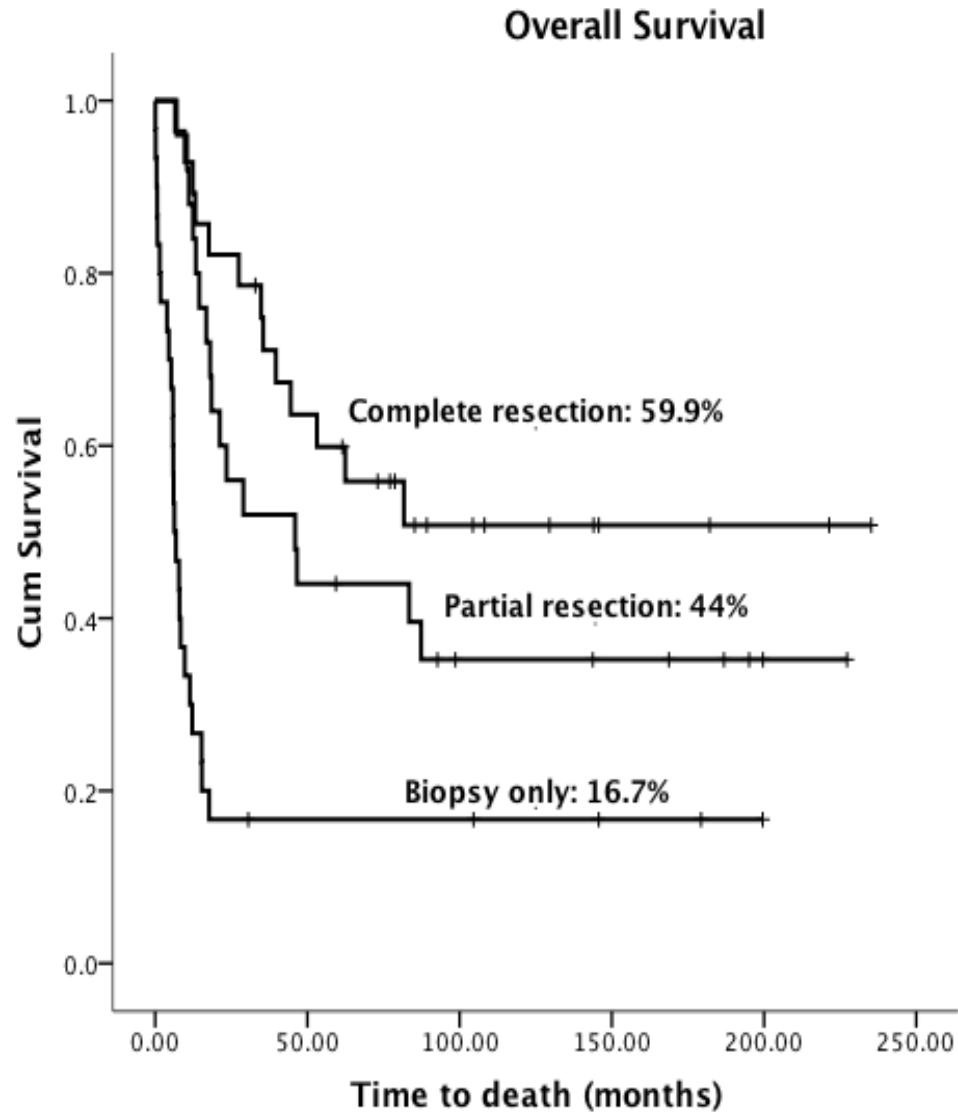
# 5-year overall survival by study era



# 5-year overall survival by study era



# 5-year overall survival by degree of resection



# Relapses

■ Extend of resection	Local relapse	Metastatic relapse	Local and metastatic relapse
Complete resection	2	6	3
Partial resection	1	8	3
Biopsy only	1	1	1

Author (Year)	Study period	N°	Stage(s)	Results
Kubota (2010)	1967-2006	103	INSS 1-4S	<p>20-year OS:</p> <ul style="list-style-type: none"> <li>• Aggressive surgery group 30.2%, plateau 3 years</li> <li>• Aggressive chemo group 30% (a second major drop after 10 years due to late mortality)</li> </ul> <p>Highlights the importance of long-term assessment of survival benefit of different treatment strategies.</p>
Kiely (2007)	1983-2005	255	INSS 1-4	<p>5-year survival for stage 3: CR 85%, PR 40%; Stage 4: CR 30%, PR 30.6%.</p> <p>Complete excision of stage 1-3 conferred survival advantage, the same cannot be said for stage 4 disease.</p>
von Allmen (2005)		76	INSS 3, 4	<p>Overall EFS 56%.</p> <p>Completeness of resection (surgeon's view) was not associated with a difference in EFS or OS.</p>
La Quaglia (2004)	1979-2002	141	INSS 4	<p>Overall survival rate in GTR+ 50%, GTR- 11% (p&lt;0.01).</p>

Author (Year)	Study period	N°	Stage(s)	Results
Adkins (2004)	1991-1996	539	Evans II, III, IV INSS 2b, 3, 4	5-year EFS for CR 30%, less than CR 25% (p = 0.1010).
von Schweinitz (2002)	1979-1999	2251	Evans I-IVS INSS 1-4s	5-year EFS for children >1yr with stage 3: CR 71%, PR 48% (p=0.02), insignificant difference for <1yr children. 5-year EFS in stage IV (early study period): CR 22%, PR 12%; stage 4 (later study period): CR 32%, PR 32% (no significant difference). Radical tumour excisions only justified in children >1yr with localised disease.
Castel (2002)	1992-1999	98	INSS 4	5-year EFS 32% overall, 0 for children having biopsy only (n=27), 25% for <50% resection (n=4), 31% for 50-90% resection (n=7), 44% for >90% resection (n=21), 33% for complete resection (n=39).  The degree of resection did not influence outcome.
Tsuchida (2002)	1985-1993	66	INSS 3, 4, 4s with MYCN amplification	5-year EFS 29%. 95% (18) of long-term survivors had total resection vs 84% (38) of those who died (p>0.05). Author concluded that prerequisites for survival incl intensive chemo, total tumour resection +metastases, and ABMT/PBSCT without major time delay.

# Conclusion

- No survival advantage from complete surgical resection for advanced stage neuroblastoma
- Improved outcomes may be linked to evolving cancer therapies



# Future directions

- New chemotherapy regimens – improved tumour resectability
- Immunotherapy – anti-GD2 mAb?
- ‘Personalised’ therapies:
  - *MYCN*
  - DNA ploidy
  - Chromosomes 1p, 17q
  - Etc.

