# The Battle of the MAG3s

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# Introduction

Historically, Mallinckrodt was the only supplier for MAG3 kits.



- In 2012, a QA failure on the vials led to a national shortage.
  - During this time, IEL were allowed to distribute a limited quantity of an alternative product (which is now fully available)

# Introduction

- We initially validated the radiopharmaceutical purity of the new MAG3 and accepted it as equivalent.
- However, after several hundred patients, one of our radiographers mentioned that liver visualisation seemed more common, which prompted a comparison of the two MAG3s.



# MAG3 vs MAG3

TechneScan MAG3 manufactured by Mallinckrodt

VS

IEL-MAG3 (Previously NephroMAG) manufactured by ROTOP

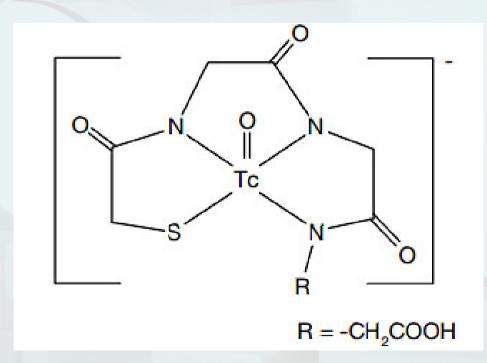
None of the authors have any conflicting interests.



# **Preliminary Observations**

Technescan MAG3: 99mTc-MercaptoAcetylGlycylGlycylGlycine

IEL-MAG3: 99mTc-MercaptoAcetyltri-Glycine



# **Preliminary Observations**

• They may both be <sup>99m</sup>Tc-MAG3, but the kits and labelling techniques are markedly different

• There are obvious production and logistical differences:

One doesn't need boiling
One has a longer shelf time



# **TechneScan MAG3**

• Step 1 – Add <sup>99m</sup>Tc to cold kit

(At this point the <sup>99m</sup>Tc is not bound to the MAG3)

- Step 2 Boil the mixture for 10 minutes
   (The boiling process binds the <sup>99m</sup>Tc to the MAG3)
- Step 3 Cool the mixture for 10 minutes
   (To avoid injecting boiling hot liquid into patients)





## **IEL-MAG3**

• Step 1 – Add <sup>99m</sup>Tc to alkaline kit

(The alkalinity makes the <sup>99m</sup>Tc bind to the MAG3)

Step 2 – Add a second solution to neutralise the pH

(To avoid injecting alkaline solution into patients)

Step 3 – pH test the final product

(To avoid injecting alkaline solution into patients)





### **Practicalities**

### Conventional (boil) TechneScan MAG3

- Boiling and cooling a product is time consuming in a busy radiopharmacy
- · Short shelf life of 4 hours

### These are conflicting things!

To prepare radiopharmaceuticals for delivery on time, the MAG3 had to be prepared first to allow time for boiling and cooling, which meant that the effective shelf life was further reduced.

### New (non-boil) IEL-MAG3

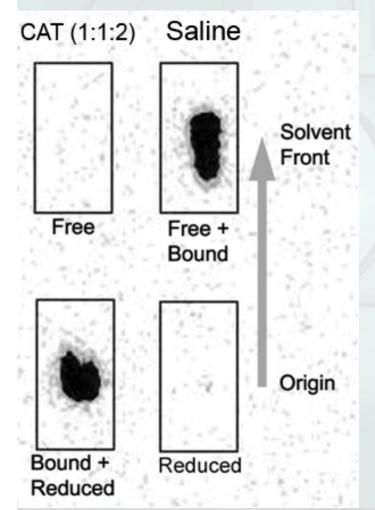
- Simpler to prepare
- Longer shelf life of 6 hours

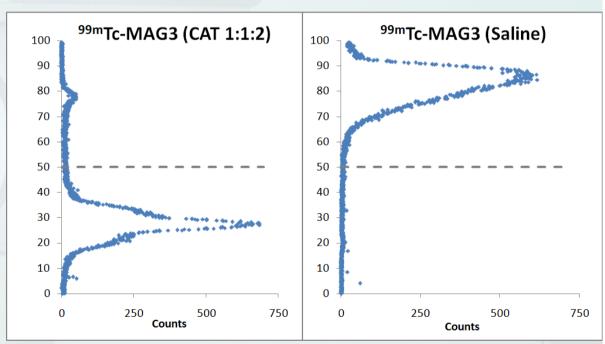
This can be labelled later in the production run and takes less time so radiopharmaceuticals can be dispatched sooner



# Radiopharmaceutical Purity Tests

Chromatography strips with CAT 1:1:2 and saline (now quantified using an automatic scanner)







# Radiopharmaceutical Purity Tests

	TechneScan MAG3	IEL-MAG3
# batches tested	10	7
Average Reduced Tc99m	0.5%	0.2%
Average Free Tc99m	1.1%	0.3%
Average Bound Tc99m	98.4%	99.5%

### Statistical significance:

The two-tailed P value is 0.077

By conventional criteria, this difference is considered to be *not quite* statistically significant.



# **Clinical Comparison**

### Available data:

668 MAG3 scans at RSCH + Frimley Park Hospitals in 2011 to 2013

To reduce the effect of the many variables that are intrinsic to retrospective clinical comparisons:

- •Only patients that had scans with both MAG3s (in any order) within 12 months were included.
- Patients that had surgery between their scans were excluded

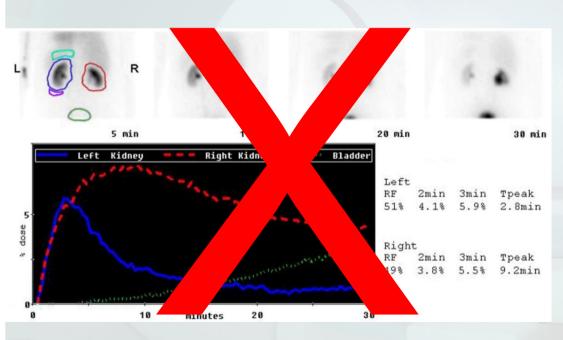
98 scans from 40 patients included in clinical comparison

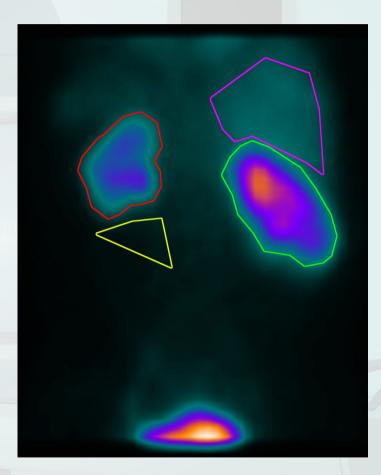


# **Method in Clinical Audit**

Too many variables when comparing renogram curves – needed a simple, consistent approach.

- Compared using ROI on post mict statics



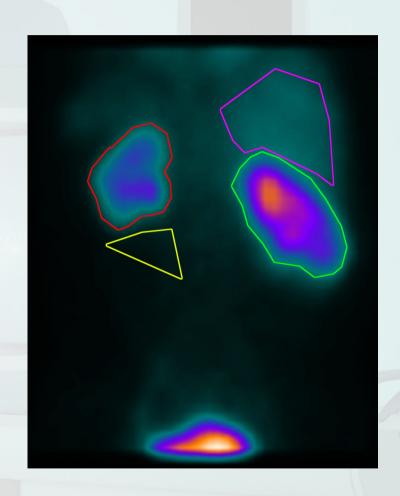




# **Method in Clinical Audit**

# Kidney Liver retention after 1hr Tissue Left / Right differential function

# Not considered Kidney uptake or clearance Liver uptake or clearance Furosemide usage Clinical history (apart from surgery) Administered activity





# **Clinical Audit**

TechneScan MAG3	IEL-MAG3
34.7 cts/px	33.5 cts/px
10.4 cts/px	9.6 cts/px
4.9 cts/px	4.4 cts/px
7.4 * BGD	7.6 * BGD
2.1 * BGD	2.1 * BGD
	34.7 cts/px 10.4 cts/px 4.9 cts/px 7.4 * BGD

### Statistical significance:

By conventional criteria, these differences are not statistically significant.



# Conclusion

Both agents appear equivalent in terms of -

- Radiopharmaceutical purity
- Kidney, liver and background retention

### **Conventional (boil) MAG3**

- Takes longer to prepare
- Short shelf life of 4 hours

### IEL (non-boil) MAG3

- Much quicker to prepare
- Longer shelf life of 6 hours



### The End.

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WHY DO WHALES JUMP & WHY ARE WITCHES GREEN WHY ARE THERE MIRRORS ABOVE BEDS WHY ARE THERE TREES IN THE MIDDLE OF FIELDS WHY IS THERE NOT A POKEMON MMO -WHY IS THERE LAUGHING IN TV SHOWS WHY ARE THERE DOORS ON THE FREEWAY WHY ARE THERE SO MANY SYCHOST. EXE RUNNING . WHY AREN'T THERE ANY COUNTRIES IN ANTARCTICA WHY ARE THERE SCARY SOUNDS IN MINECRAFT WHY IS THERE KICKING IN MY STOMACH TO WHY AREN'T ECON

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WHY IS SEX **50 IMPORTANT** 

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WHY DO GOOD PEOPLE DIE WHY AREN'T THERE GUNS IN HARRY POTTER

WHY IS JESUS WHITE G

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