RESULTS

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This study was conducted upon 35 patients receiving amino-glycosides.

All patients were hospitalized at Benha University Hospital in Urology department and at Benha Teaching Hospital.

In order to compare between nephrotoxicity in using different aminoglycosides, patients were divided into four groups according to the aminoglycoside used :

1] Ten patients received gentamicin.

2] Ten patients received tobramycin.

3] Ten patients received amikacin.

4] Five patients received netilmicin.

Sex :

- Four were females.
- Thirty-one were males.

It is clear from Table (1) that :

5 patients undergone kidney operations.

10 patients undergone ureteric operations.

5 patients undergone prostatic operations.

2 patients undergone bladder operations.

Drug treatment	No.	Mean age	Mean Hb%	Kidney operation	Ureteric operation	Bladder operation	Prostatic operation	Urethra operation	Pyelo-nephritis	Cystitis	etc.
Gentamicin	10	44.7	73.6	1	2		2	1	2	2	
Tobramycin	10	31.4	71.6		5	1		2	1	1	
Amikacin	10	42.1	75.6	3	2	1		1	1	1	1
Netilmicin	5	64.4	72.8	1	1		3				

Table (1) : The various clinical and surgical data among treatment groups.

4 patients undergone urethral operations.

1 patient undergone surgical operation (epigastric H).

4 patients were suffering from pyelonephritis.

4 patients were suffering from cystitis.

(FOLLOW UP STUDY)

Table (2) : Gentamicin nephrotoxicity

No. of day	First-day pre-treatm.	Third-day of treatment	Sixth-day of treatment	Tenth-day of treatment
Mean blood urea value	41.5	44	40	37
Mean serum creatinine value	1.83	2.07	2.05	1.8
Mean creatinine clearance value	94.74	-	-	96.88

The gentamicin group :

This group was composed of ten patients. The dose of administration was 3 mg./Kg. body weight/day divided into three equal doses every 8 hours. Their ages ranged from 14 to 65 years; mean age was 44.7 years ± 17.731 years.

This group had the following diseases; one patient undergone a kidney operation, two ureteric operation, two prostatic operations, one urethral operation, two patients suffering from

pyelonephritis and two patients suffering from cystitis. Mean Hb was 73.6 ± 3.26%.

Blood urea :

- At the first day, blood urea ranged from 20 to 85 mg.% with a mean of 41.5 ± 18.580 mg.%.
- On the third day, blood urea ranged from 25 to 65 mg.% with a mean of 44 ± 15.937 mg.%.
- On the sixth day, blood urea ranged from 25 to 65 mg.% with a mean of 44 ± 15.937 mg.%.
- On the tenth day of therapy, blood urea ranged from 20 to 55 mg.% with a mean of 37 ± 12.288 mg.%.

Serum creatinine :

- At the first day, serum creatinine ranged from 1 to 2.5 mg.% with a mean of 1.83 ± 0.447 mg.%.
- On the third day, serum creatinine ranged from 1.5 to 3 mg.% with a mean of 2.07 ± 0.398 mg.%.
- On the sixth day, serum creatinine ranged from 1.5 to 3 mg.% with a mean of 2.07 ± 0.398 mg.%.
- On the tenth day of therapy, serum creatinine ranged from 1.2 to 3 mg.% with a mean of 1.8 ± 0.531 mg.%.

Creatinine clearance :

- At first day, creatinine clearance ranged from 60 to 110 ml./min.with a mean of 44.74 ± 13.292 ml./min.
- On the tenth day of therapy, creatinine clearance ranged from 61 to 118 ml./min. with a mean of 96.88 ± 13.633 ml./min.

Table (3) : Tobramycin nephrotoxicity

No. of day	First day pre-treatm.	Third day treatment of operation	Sixth day treatment of operation	Tenth day treatment of operation
Mean blood urea value	34.5	33.5	34	33
Mean serum creatinine value	1.98	1.98	1.96	1.77
Mean creatinine clearance value	76.75	-	-	91.76

The tobramycin group :

This group composed of ten patients. The dose of administration was 1 mg./Kg. body weight/12 hours. Their ages ranged from 16 to 45 years with a mean of 31.4 years ± 10.239 years.

In this group, five patients undergone ureteric operations, one vesico-vaginal fistula operation, two urethral operations, one

is suffering from pyelonephritis and one is suffering from cystitis. Mean Hb% was 72.8 ± 4.069 %.

Blood urea :

- At first day, blood urea ranged from 25 to 50 mg.% with a mean of 34.5 ± 6.873 mg.%.
- On the third day, blood urea ranged from 25 to 50 mg.% with a mean of 33.5 ± 8.077 mg.%.
- On the sixth day, blood urea ranged from 25 to 50 mg.% with a mean of 34 ± 7 mg.%.
- On the tenth day of therapy, blood urea ranged from 20 to 50 mg.% with a mean of 33 ± 9 mg.%.

Serum creatinine :

- At the start of therapy, serum creatinine ranged from 1 to 3.5 mg.% with a mean of 1.98 ± 0.785 mg.%.
- On the third day, serum creatinine ranged from 1.5 to 2.5 mg.% with a mean of 1.98 ± 0.46 mg.%.
- On the sixth day, serum creatinine ranged from 1.5 to 2.5 mg.% with a mean of 1.96 ± 0.352 mg.%.
- On the tenth day of therapy, serum creatinine ranged from 1.1 to 2.5 mg.% with a mean of 1.77 ± 0.488 mg.%.

Creatinine clearance :

- At the first day, creatinine clearance ranged from 61 to 100 ml./min. with a mean of 76.75 ± 14.919 ml./min.
- On the tenth day of therapy, creatinine clearance ranged from 60 to 126ml./min. with a mean of 91.76 ± 22.44 ml./min.

Table (4) : Amikacin nephrotoxicity

No. of day	First day pre-treatm.	Third day treatment of operation	Sixth day treatment of operation	Tenth day treatment of operation
Mean blood urea value	37	37.5	37.5	33.5
Mean serum creatinine value	1.51	1.69	1.69	1.15
Mean creatinine clearance value	95.1	-	-	103

The amikacin group :

This group composed of ten patients. The dose of administration was 15 mg./Kg. body weight/day divided into two equal doses every 12 hours. Their ages ranged from 16 to 70 years with a mean of 42.1 years ± 18.780 years.

In this group, three patients undergone kidney operations, two patients undergone ureteric operations, one for bladder operation, one for urethral operation, one is suffering from pyelonephritis and the last one is suffering from cystitis. Mean Hb% was 75.6 ± 4.608 %.

Blood urea :

- At the first day, blood urea ranged from 30 to 65 mg.% with a mean of 37 ± 8.42 mg.%.
- On the third day, blood urea ranged from 25 to 65 mg.% with a mean of 37.5 ± 10.781mg.%.
- On the sixth day, blood urea ranged from 25 to 60 mg.% with a mean of 37.5 ± 10.781 mg.%.
- On the tenth day of therapy, blood urea ranged from 25 to 60 mg.% with a mean of 33.5 ± 9.5 mg.%.

Serum creatinine :

- At the start of therapy, serum creatinine ranged from 0.8 to 3.3 mg.% with a mean of 1.51 ± 0.552 mg.%.
- On the third day, serum creatinine ranged from 0.8 to 2.3 mg.% with a mean of 1.69 ± 0.652 mg.%.
- On the sixth day, serum creatinine ranged from 0.8 to 2 mg.% with a mean of 1.69 ± 0.651 mg.%.
- On the tenth day of therapy, serum creatinine ranged from 0.8 to 1.5 mg.% with a mean of 1.15 ± 0.420 mg.%.

Creatinine clearance :

- At the start of therapy, creatinine clearance ranged from 84 to 114 ml./min. with a mean of 95.1 ± 13.634 ml./min.
- On the tenth day of therapy, creatinine clearance ranged from 98 to 115 ml./min. with a mean of 103 ± 10.507 ml./min.

Table (5) : Netilmicin nephrotoxicity

No. of day	First day pre-treatm.	Third day treatment of operation	Sixth day treatment of operation	Tenth day treatment of operation
Mean blood urea value	30	36	45	45
Mean serum creatinine value	1.96	1.98	2.22	2.22
Mean creatinine clearance value	83.22	-	-	80.92

The netilmicin group :

This group composed of five patients. The dose of administration was 4 mg./Kg. body weight/day divided into two equal doses every 12 hours. Their ages ranged from 50 to 70 years with a mean of 64.4 years ± 7.446 years.

In this group, one patient undergone kidney operation, another ureteric operation and three patients for prostatic operations. Mean Hb% was 72.8 ± 4.069 %.

Blood urea :

- At the start of therapy, blood urea ranged from 20 to 35 mg.% with a mean of 30 ± 5.477 mg.%.
- On the third day, blood urea ranged from 30 to 40 mg.% with a mean of 36 ± 4.890 mg.%.
- On the sixth day, blood urea ranged from 35 to 40 mg.% with a mean of 45 ± 4.472 mg.%.
- On the tenth day of therapy, blood urea ranged from 40 to 50 mg.% with a mean of 45 ± 4.472 mg.%.

Serum creatinine :

- At the start of therapy, serum creatinine ranged from 1.4 to 3 mg.% with a mean of 1.96 ± 0.665 mg.%.
- On the third day, serum creatinine ranged from 0.9 to 3 mg.% with a mean of 1.98 ± 736 mg.%.
- On the sixth day, serum creatinine ranged from 0.9 to 3 mg.% with a mean of 2.22 ± 0.747 mg.%.
- On the tenth day of therapy, serum creatinine ranged from 1.3 to 3.5 mg.% with a mean of 2.22 ± 0.747 mg.%.

Creatinine clearance :

- At the start of therapy, creatinine clearance ranged from 62.5 to 107ml./min. with a mean of 83.22 ± 19.041 ml./min.
- On the tenth day of therapy, creatinine clearance ranged from 60 to 91.6 ml./min. with a mean of 80.92 ± 22.220 ml./min.

Comparative study on nephrotoxicity of different aminglycosides :

To compare the relative nephrotoxicity, we have applied the student test (t) to compare between the different groups.

To compare between two drugs, we depend on the third day serum creatinine.

Drug composition		t	P⩾
Gentamicin	Tobramycin	0.443	70.5
Gentamicin	Amikacin	1.492	70.5
Gentamicin	Netilmicin	0.286	70.5
Tobramycin	Amikacin	1.090	70.2
Tobramycin	Netilmicin	0	70.5
Amikacin	Netilmicin	0	70.5

It is clear from Table (6) that with comparative study between :

Gentamicin and tobramycin	t = 0.443 P $\geqslant$ 70.5 (insignificant)
Gentamicin and amikacin	t = 1.492 P $\geqslant$ 70.2 (insignificant)
Gentamicin and netilmicin	t = 0.286 P $\geqslant$ 70.5 (insignificant)
Tobramycin and amikacin	t = 1.090 P $\geqslant$ 70.2 (insignificant)
Tobramycin and netilmicin	t = 0 P $\geqslant$ 70.5 (insignificant)
Amikacin and netilmicin	t = 1.806 P $\geqslant$ 70.1 (insignificant)

Table (7) shows a comparative study between the four amino-glycosides used as regards to the changes in the mean blood urea of patients before and after treatment.

Table (7) : Change in blood urea following treatment with aminoglycosides

Drug treatment	No.	Mean blood urea (mg./100 ml.)		
		Before treatment	After treatment	P⩾
Gentamicin	10	41.5	37	70.5
Tobramycin	10	34.5	33	70.5
Amikacin	10	37	33.5	70.2
Netilmicin	5	30	45	70.1

Table (8) : Changes in serum creatinine following treatment with amino-glycoside.

Drug treatment	No.	Mean serum creatinine (mg./100 ml.)		
		Before treatment	After treatment	P⩾
Gentamicin	10	1.83	1.8	70.5
Tobramycin	10	1.98	1.77	70.5
Amikacin	10	1.51	1.15	70.2
Netilmicin	5	1.96	2.22	70.5

Table (8) shows a comparative study between the four aminoglycosides as regards to the changes in the mean serum creatinine of patients before and after treatment.

Table (9) : Changes in creatinine clearance following treatment with aminoglycosides.

Drug treatment	No.	Mean creatinine clearance (ml./min.)		
		Before treatment	After treatment	P⩾
Gentamicin	10	94.74	96.88	70.5
Tobramycin	10	76.75	91.76	70.2
Amikacin	10	95.1	103	70.5
Netilmicin	5	83.22	80.92	70.5

Table (9) shows a comparative study between the four aminoglycosides as regards to the changes in the mean creatinine clearance of the patients before and after treatment.

Table (10) : Comparative nephrotoxicity between different aminoglycosides.

Drug	diff.% 1st day versus 3rd day	diff.% 1st day versus 10th day	X^2	P⩾
Gentamicin	30%	20%	1.44	0.5
Tobramycin	40%	20%	0.952	0.5
Amikacin	40%	20%	0.952	0.5
Netilmicin	40%	40%	0	0.5

Using comparative study on nephrotoxicity in terms of increase in serum creatinine over 31% which is an accurate way to follow up patients with nephrotoxicity. We have got the following results :

- Using the pre-treatment versus third day of therapy results it was found that the comparative toxicity of gentamicin was 30%, tobramycin 40%, amikacin 40%, and netilmicin 40%.
- On using pre-treatment versus the tenth day of therapy results the comparative toxicity was as follows; gentamicin 20%, tobramycin 20%, amikacin 20%, and netilmicin 40%.

All the tenth day (end of treatment with aminoglycosides) changes in the value of serum creatinine were noticed.

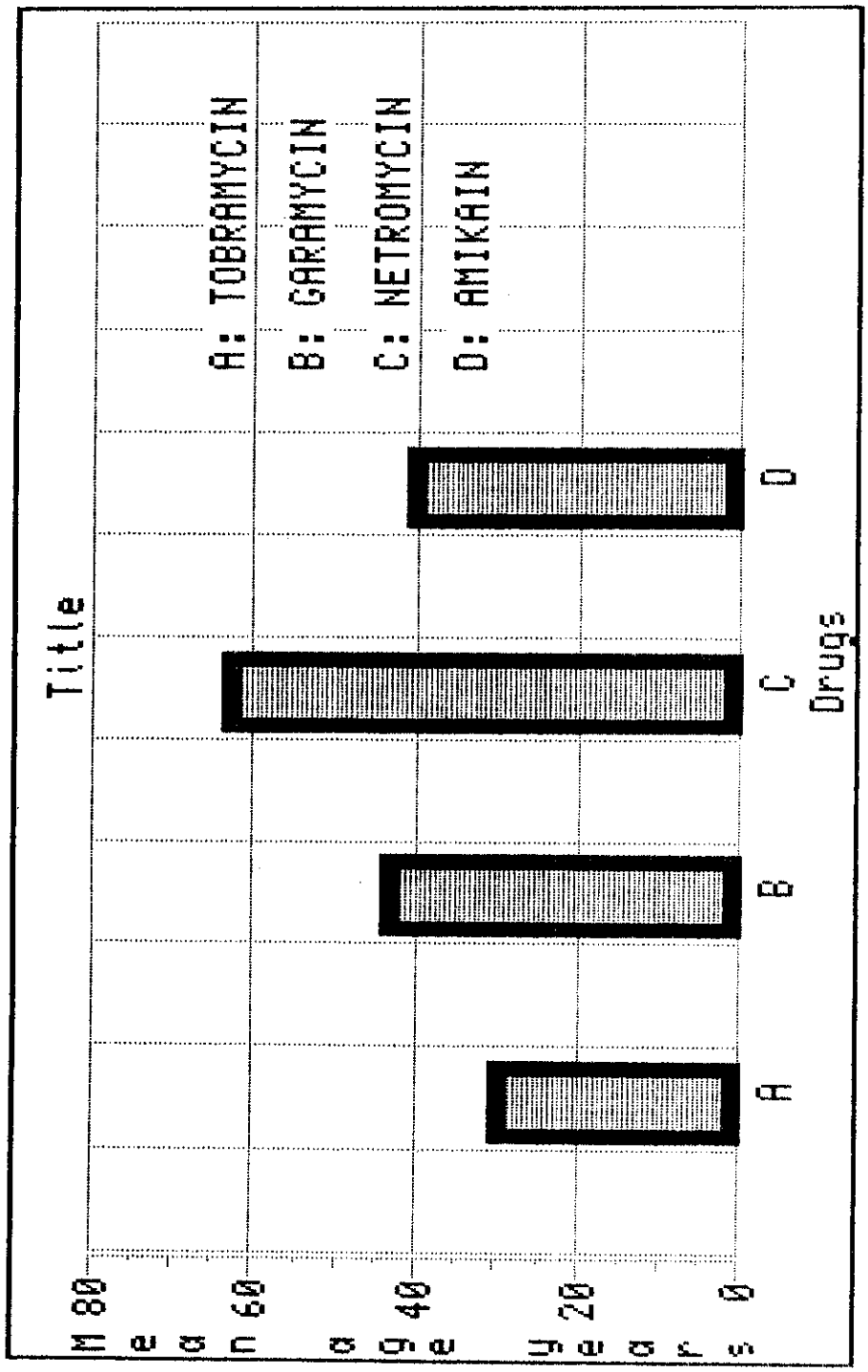
So, we considered that the difference in serum creatinine level between the pre-treatment versus the third day of treatment, and pre-treatment versus the tenth day levels as an indicator of nephrotoxicity. If the difference reached the level of 31% increase in serum creatinine, this was considered an indicator of nephrotoxic effect.

We counted the number of patients showing this nephrotoxicity founding three patients with gentamicin, four patients with tobramycin, four patients with amikacin, and two patients with netilmicin; this was the result of third day of treatment.

The tenth day of treatment showed nephrotoxicity in two patients with gentamicin, two patients with tobramycin, two patients with amikacin and two patients with netilmicin.

We compared these numbers by using X^2 test to see if there is any significant difference statistically. We compared the results of each drug separetly, the difference between nephrotoxicity at the third day and tenth day when compared with pre-treatment level was non-significant statistically.

We compared the difference between nephrotoxicity at the pre-treatment versus third day, and we compared between the different groups of drugs. We found no significant difference statistically.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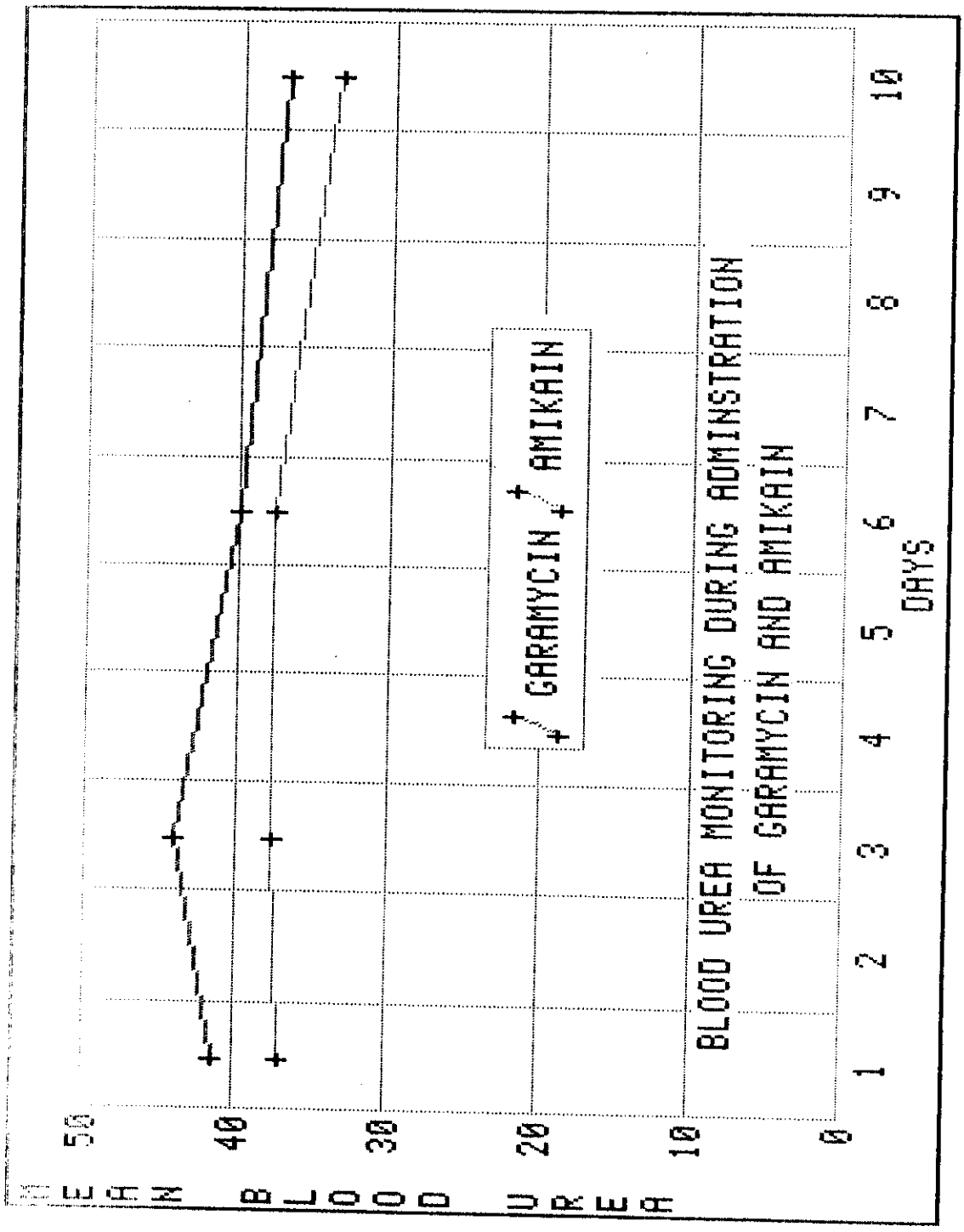
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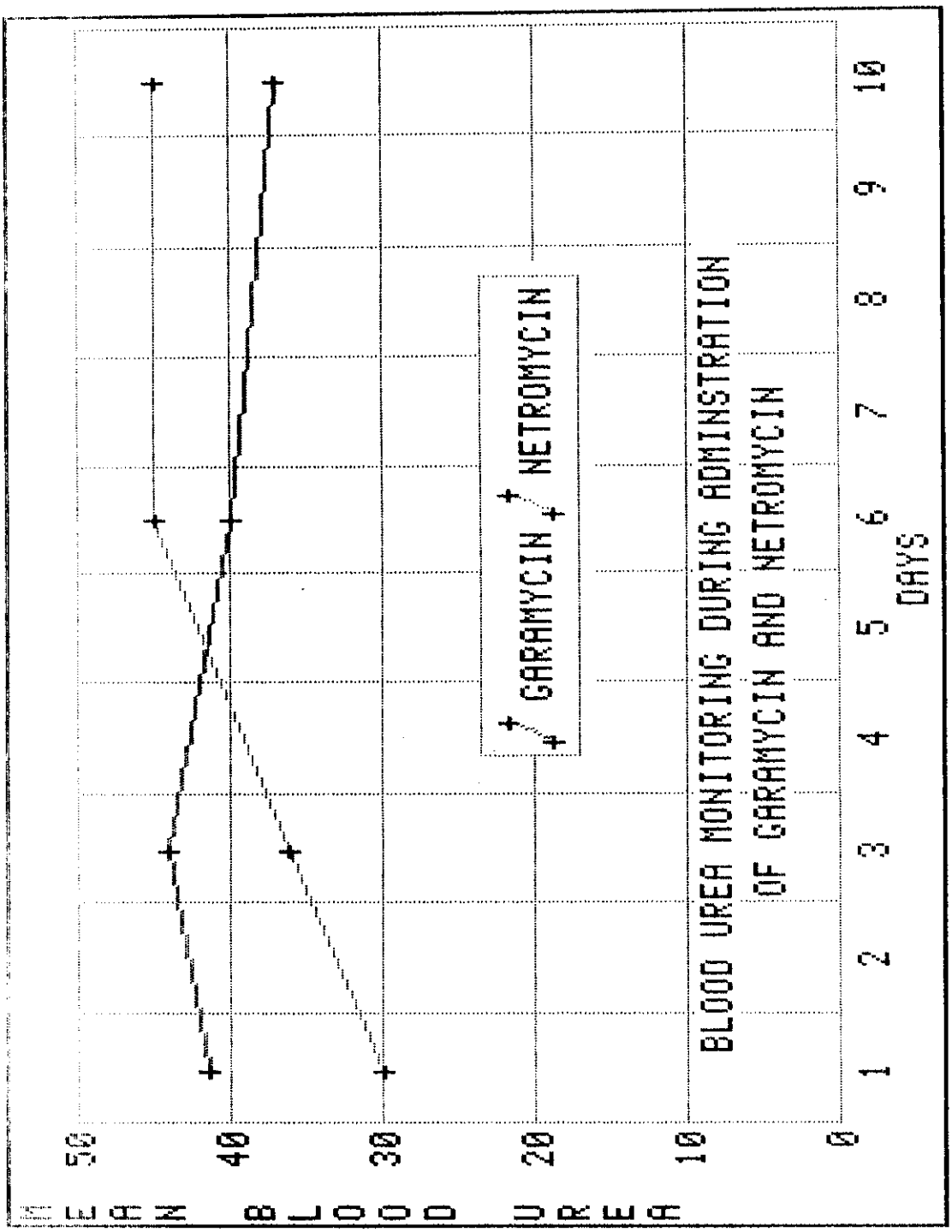
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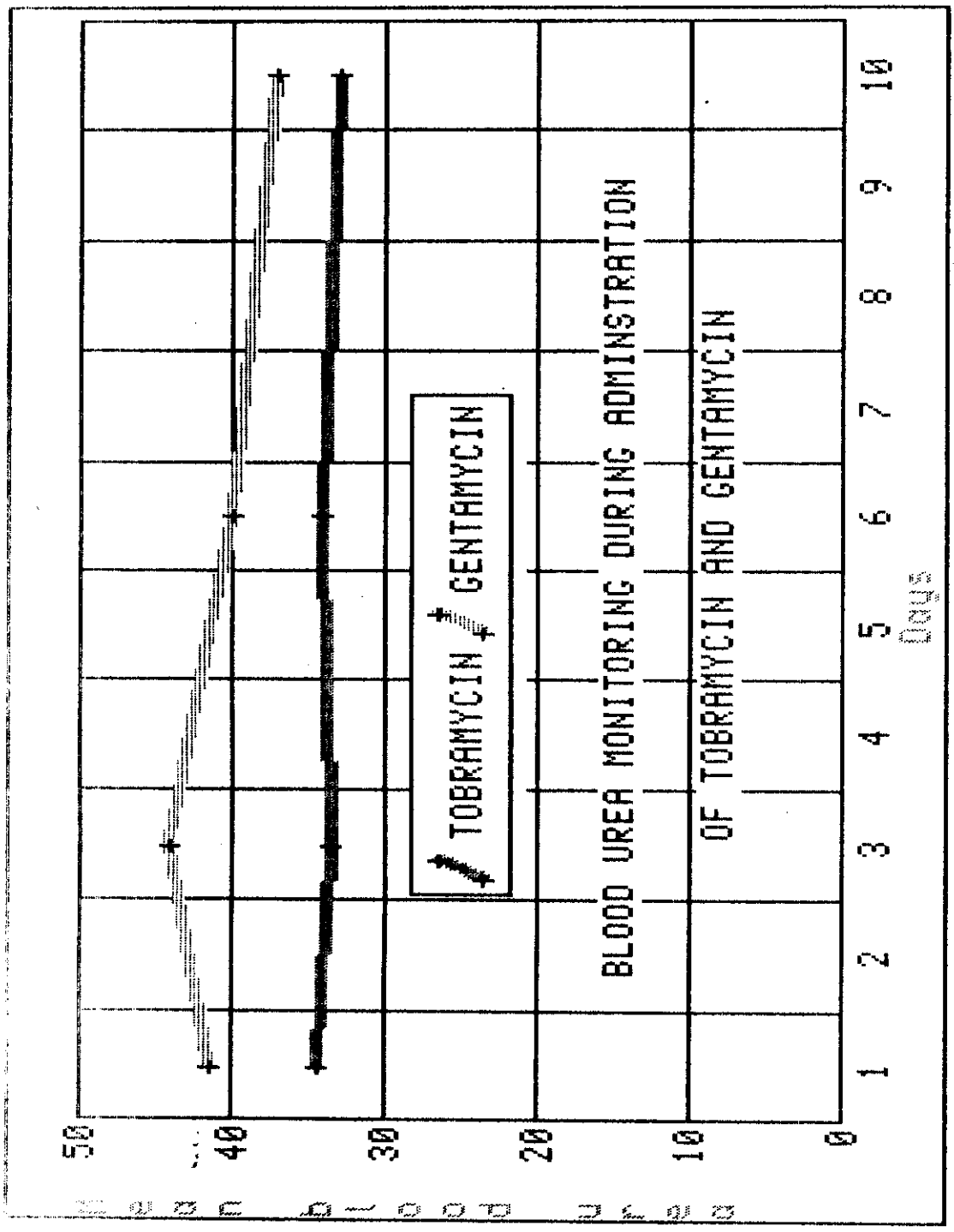
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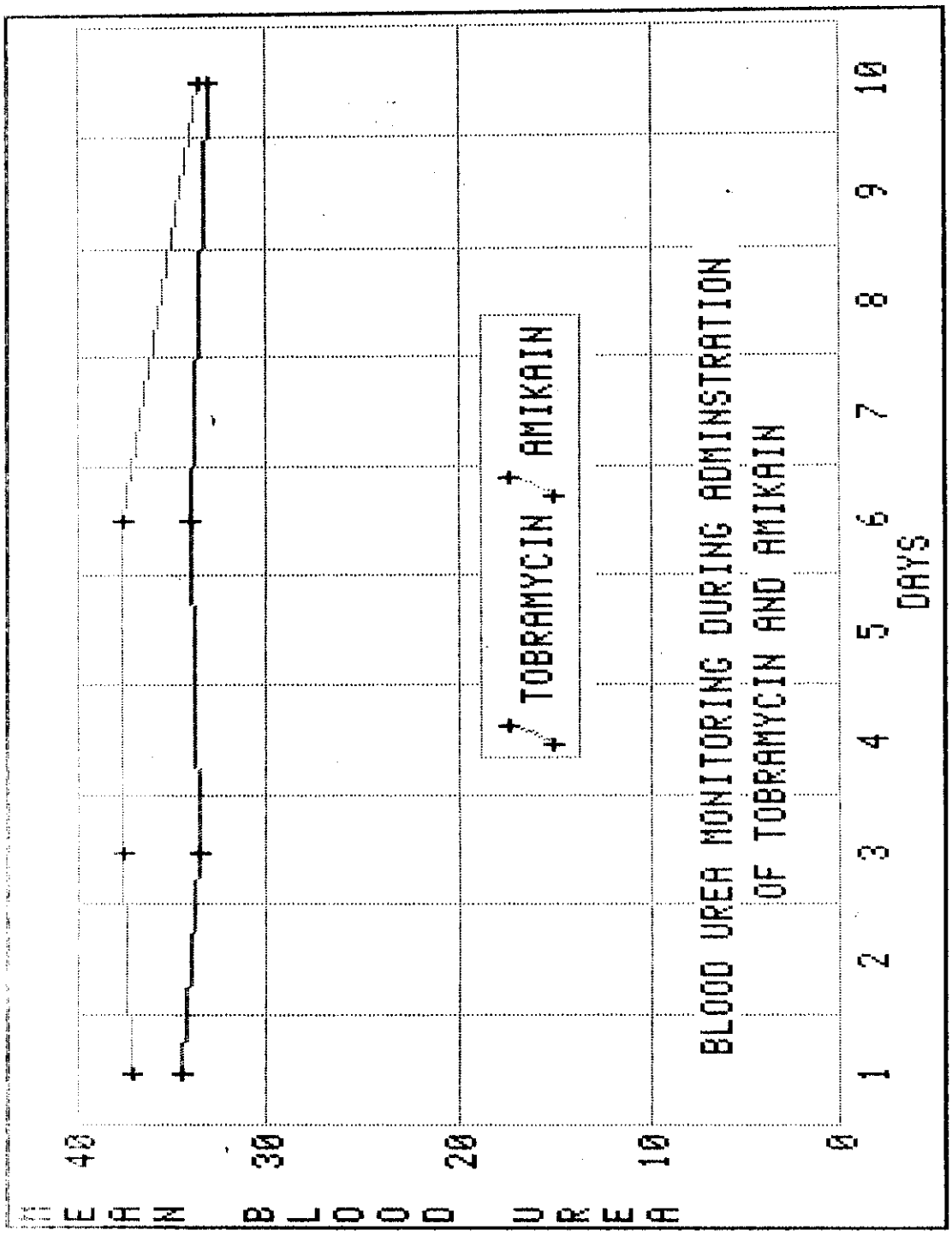
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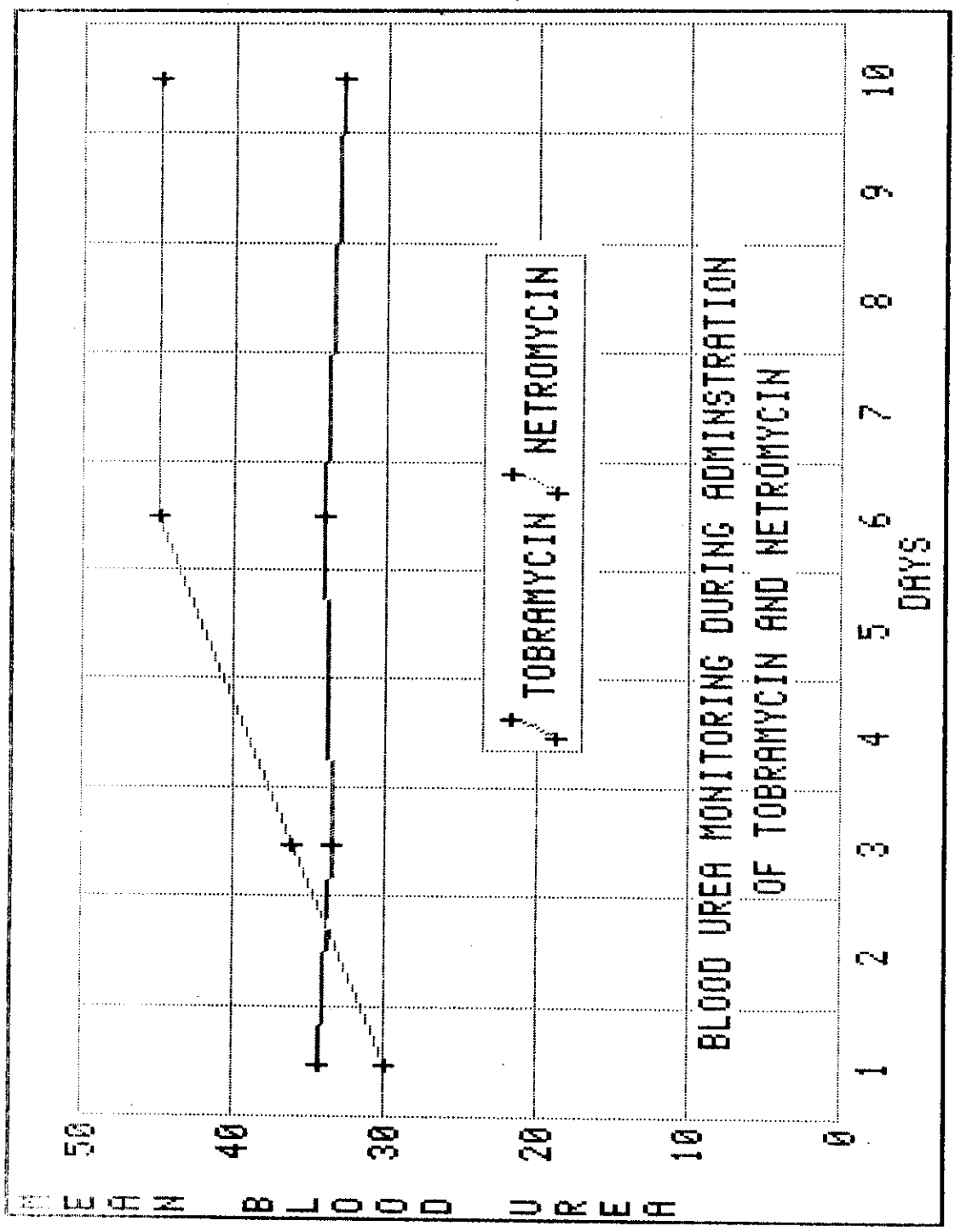
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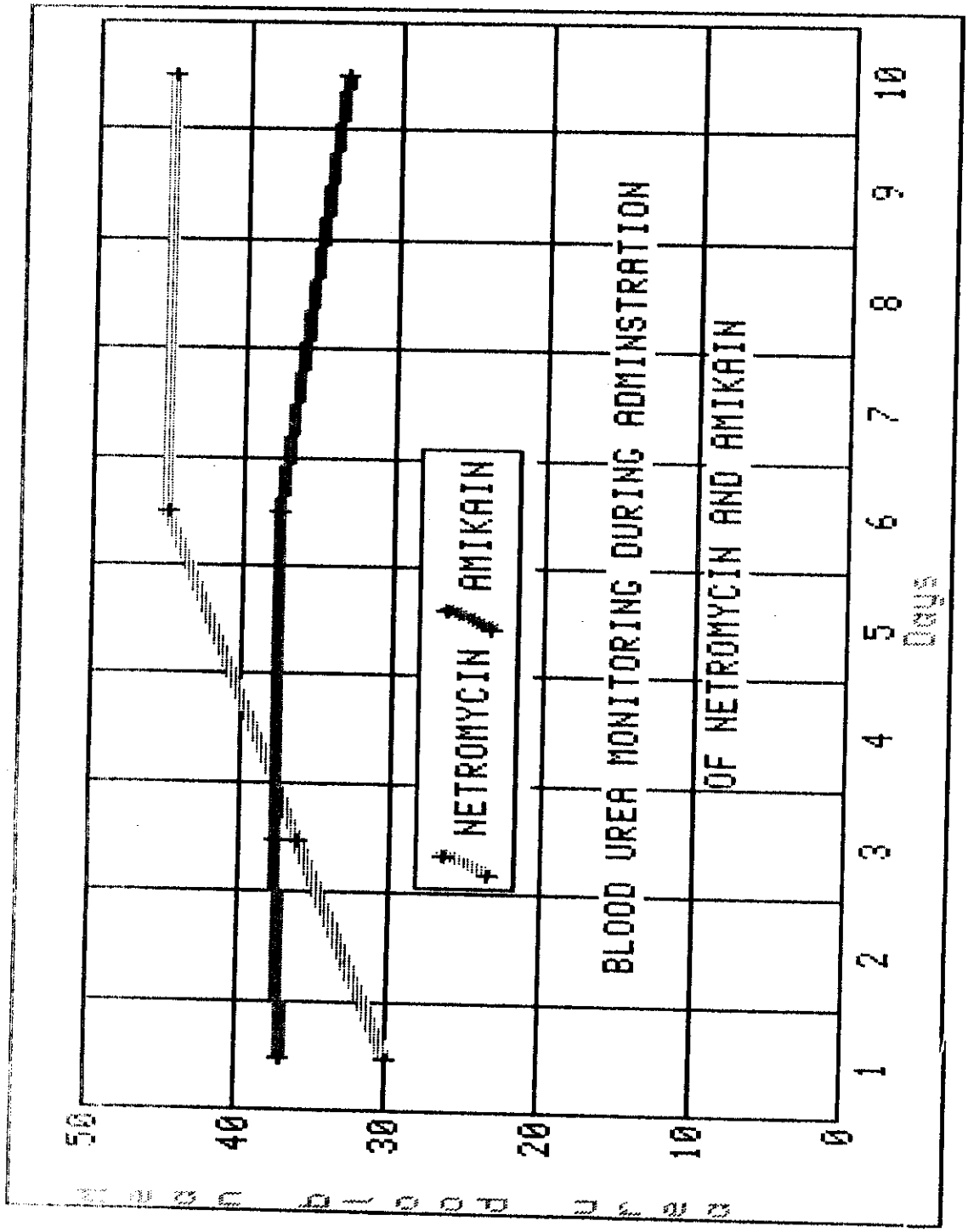
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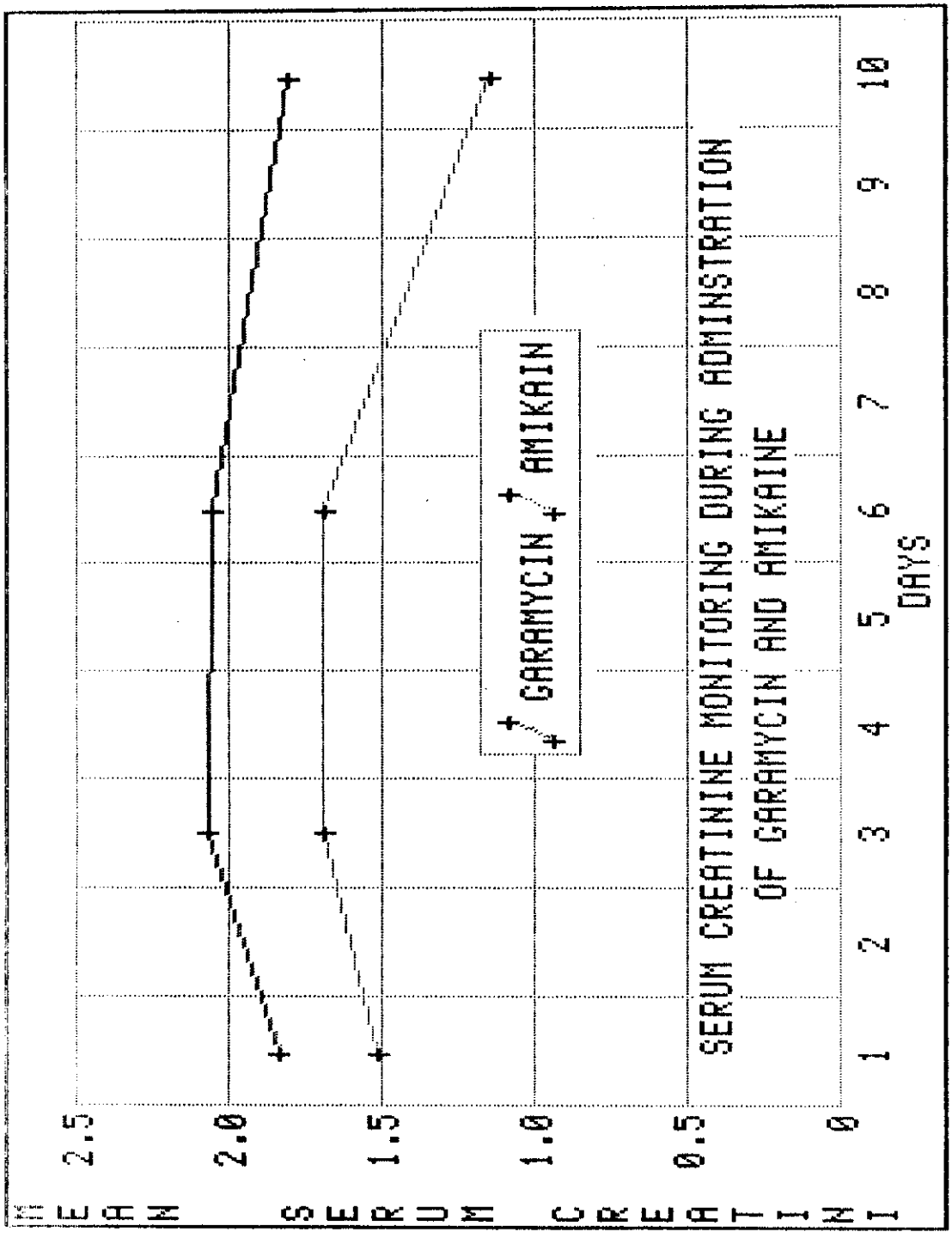
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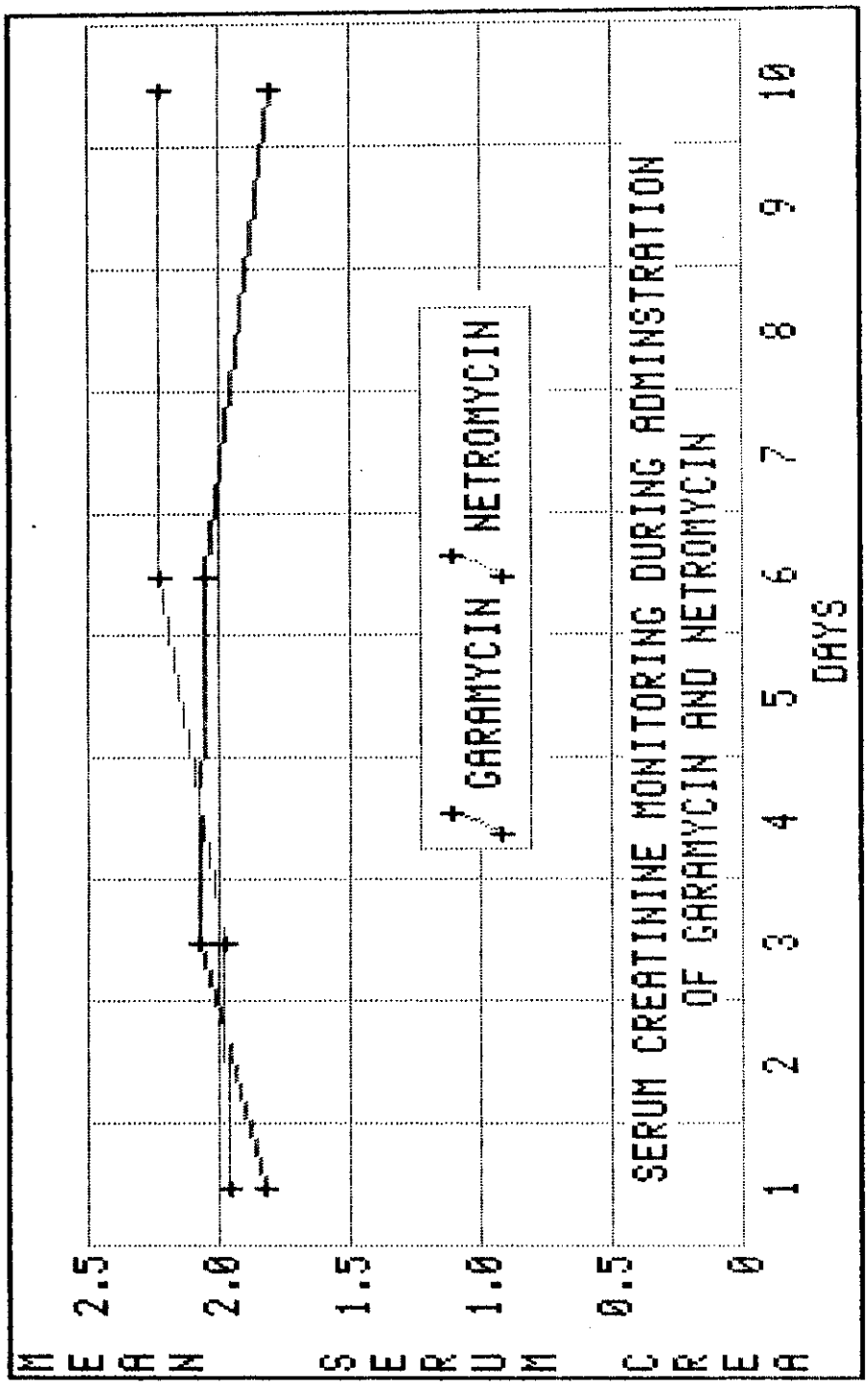
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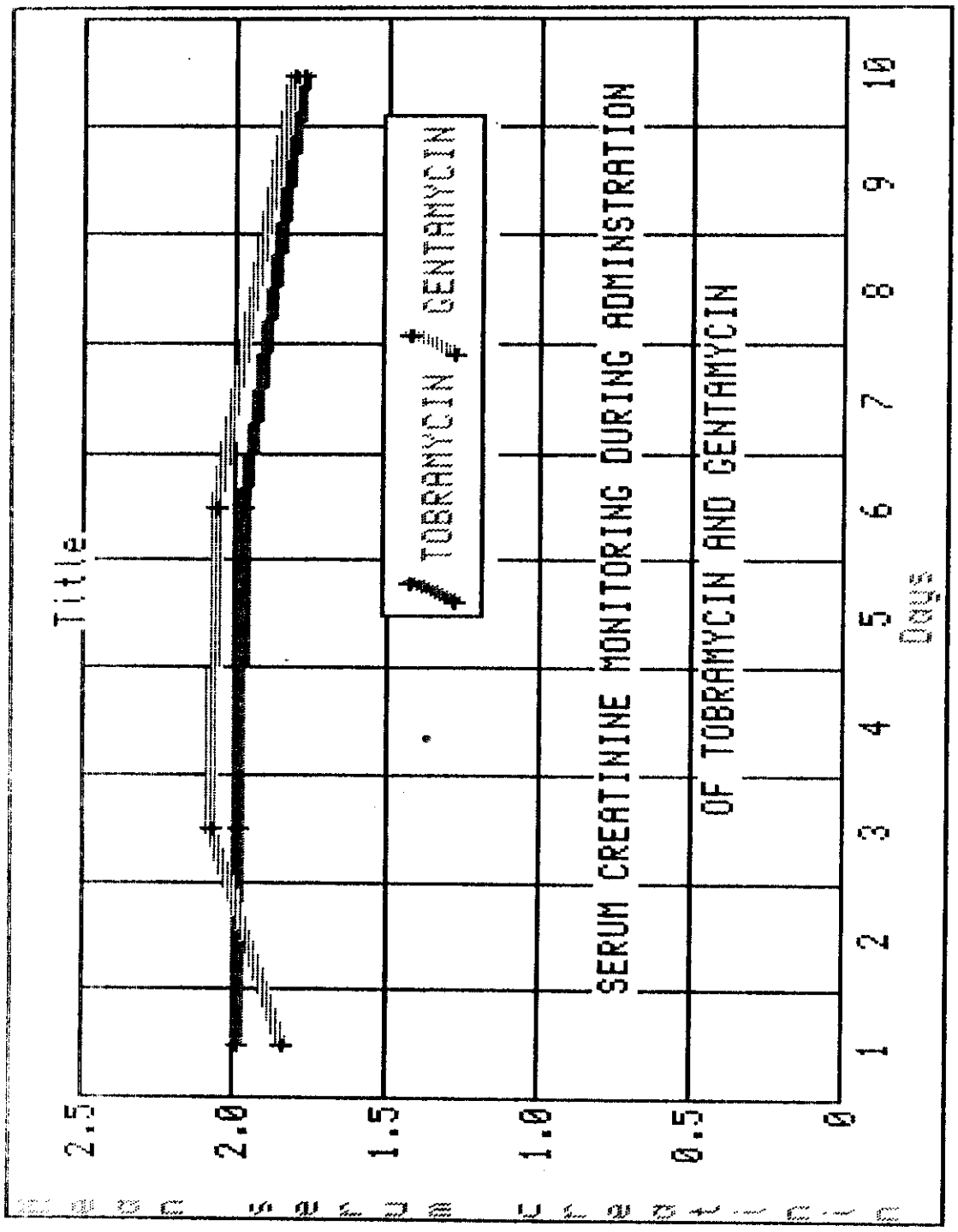
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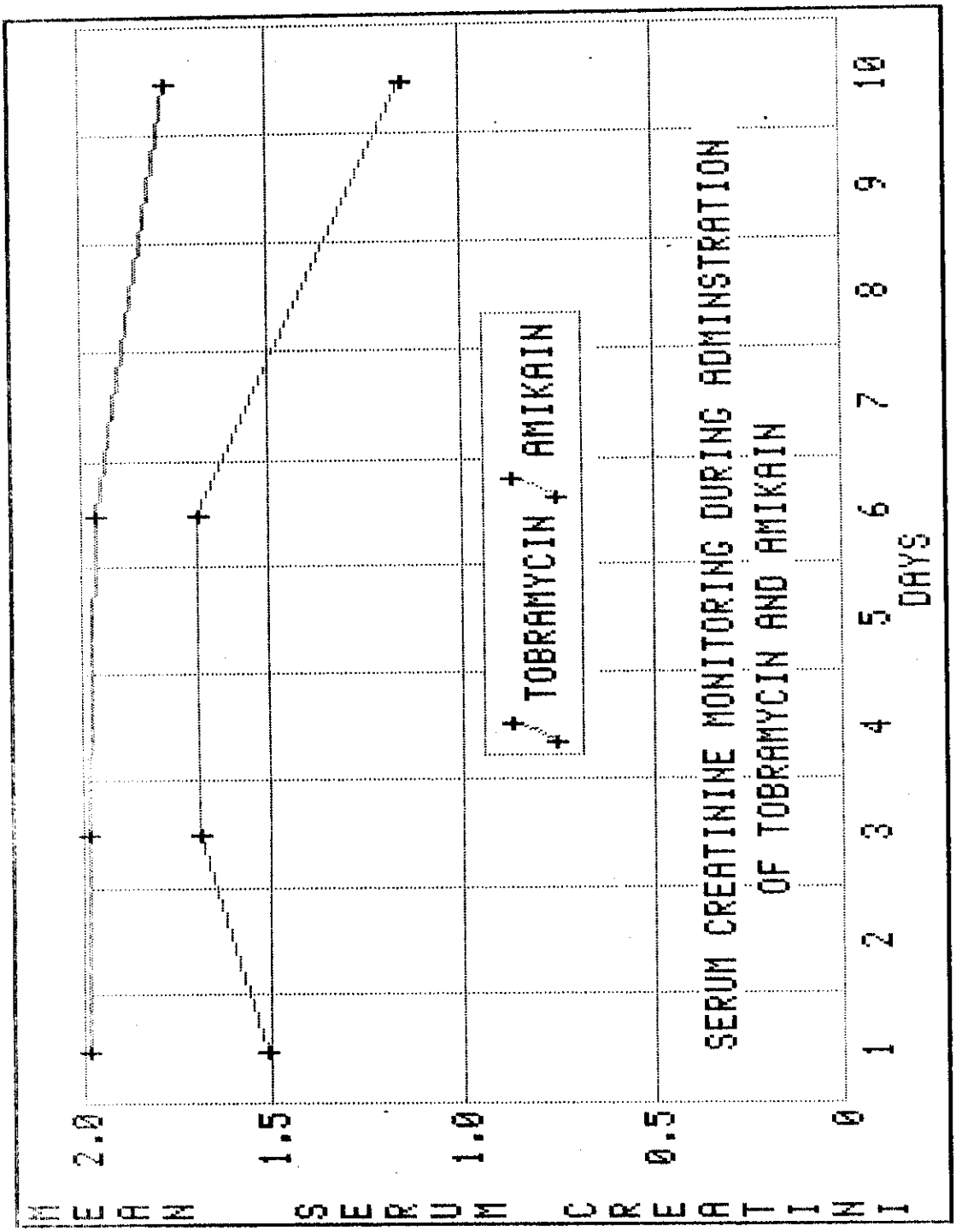
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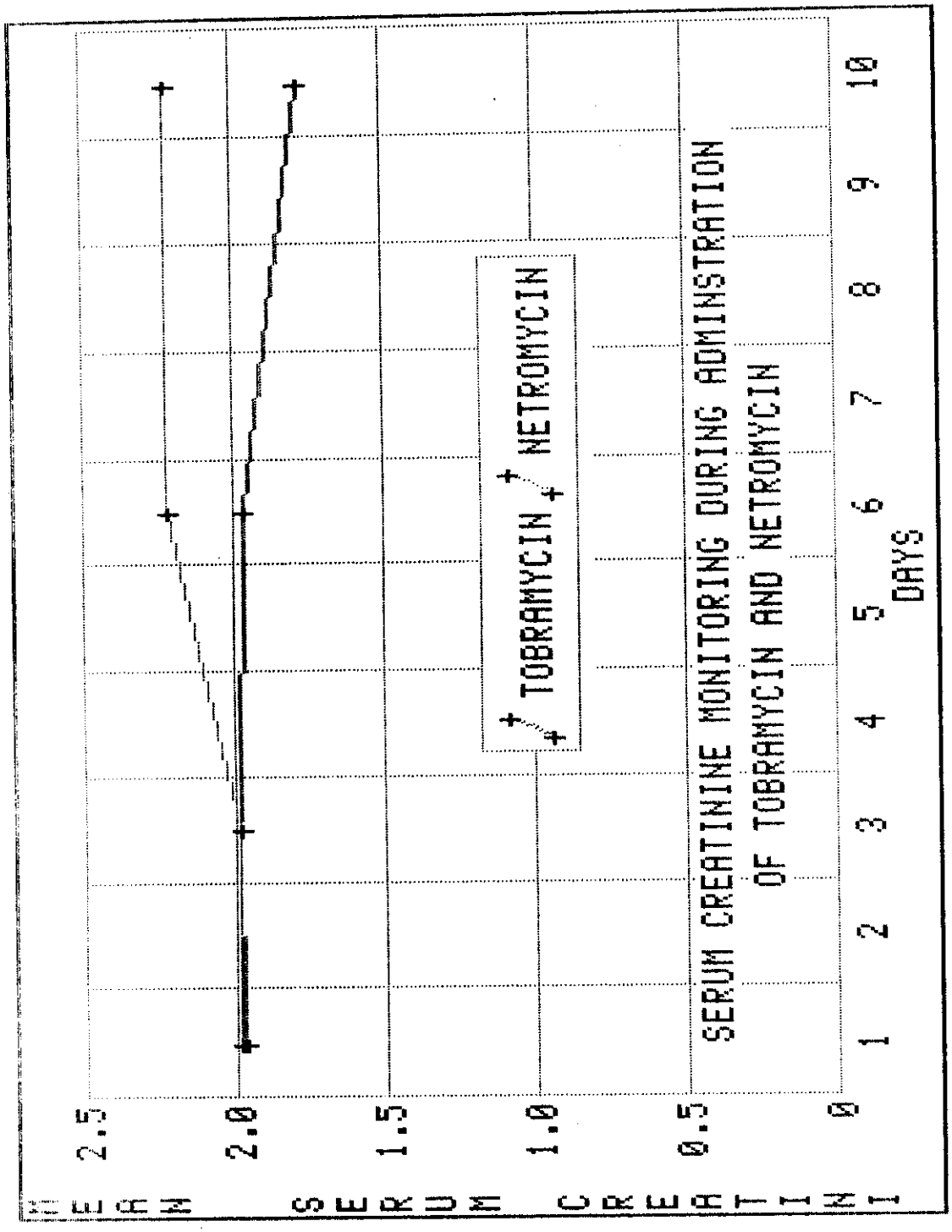
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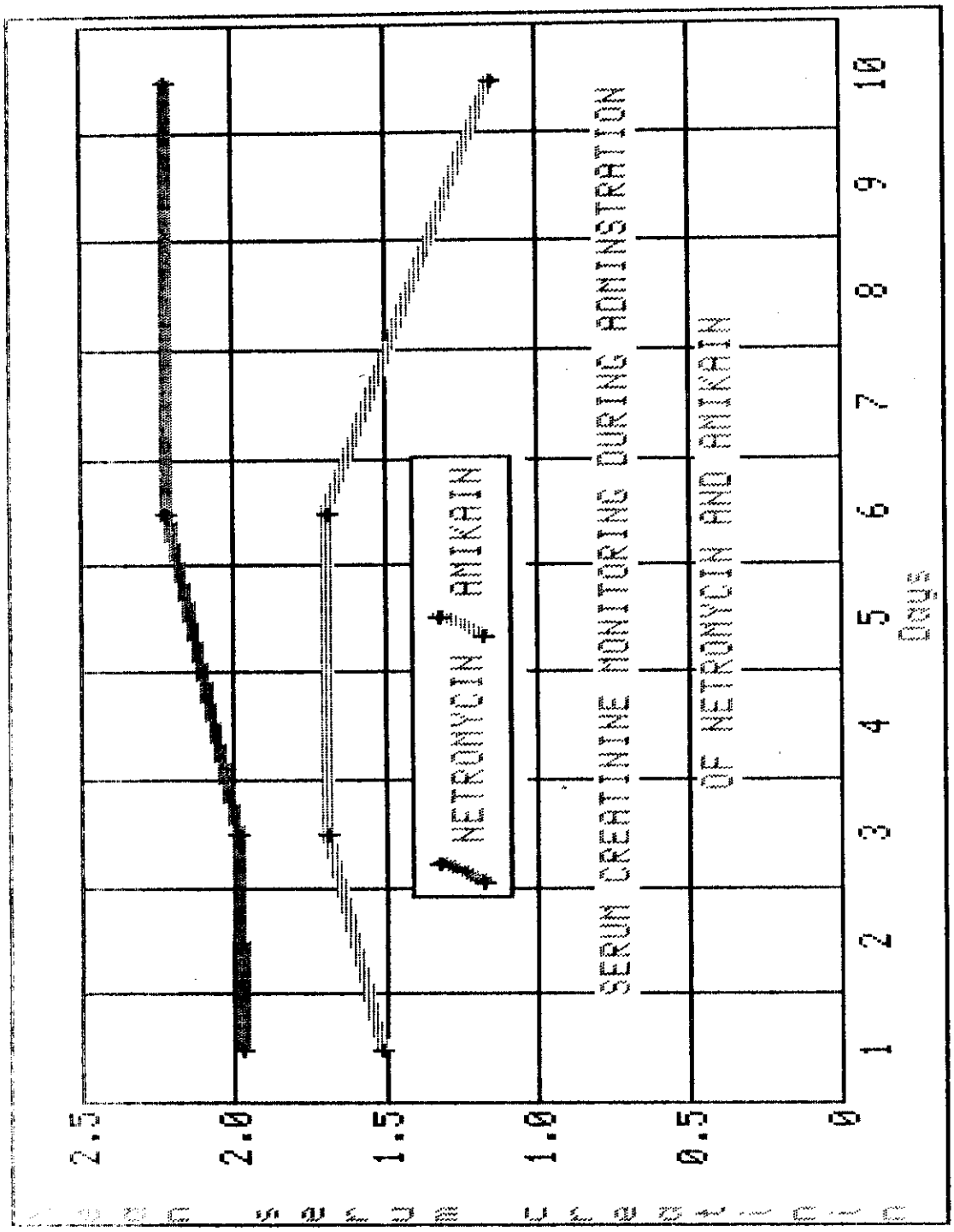
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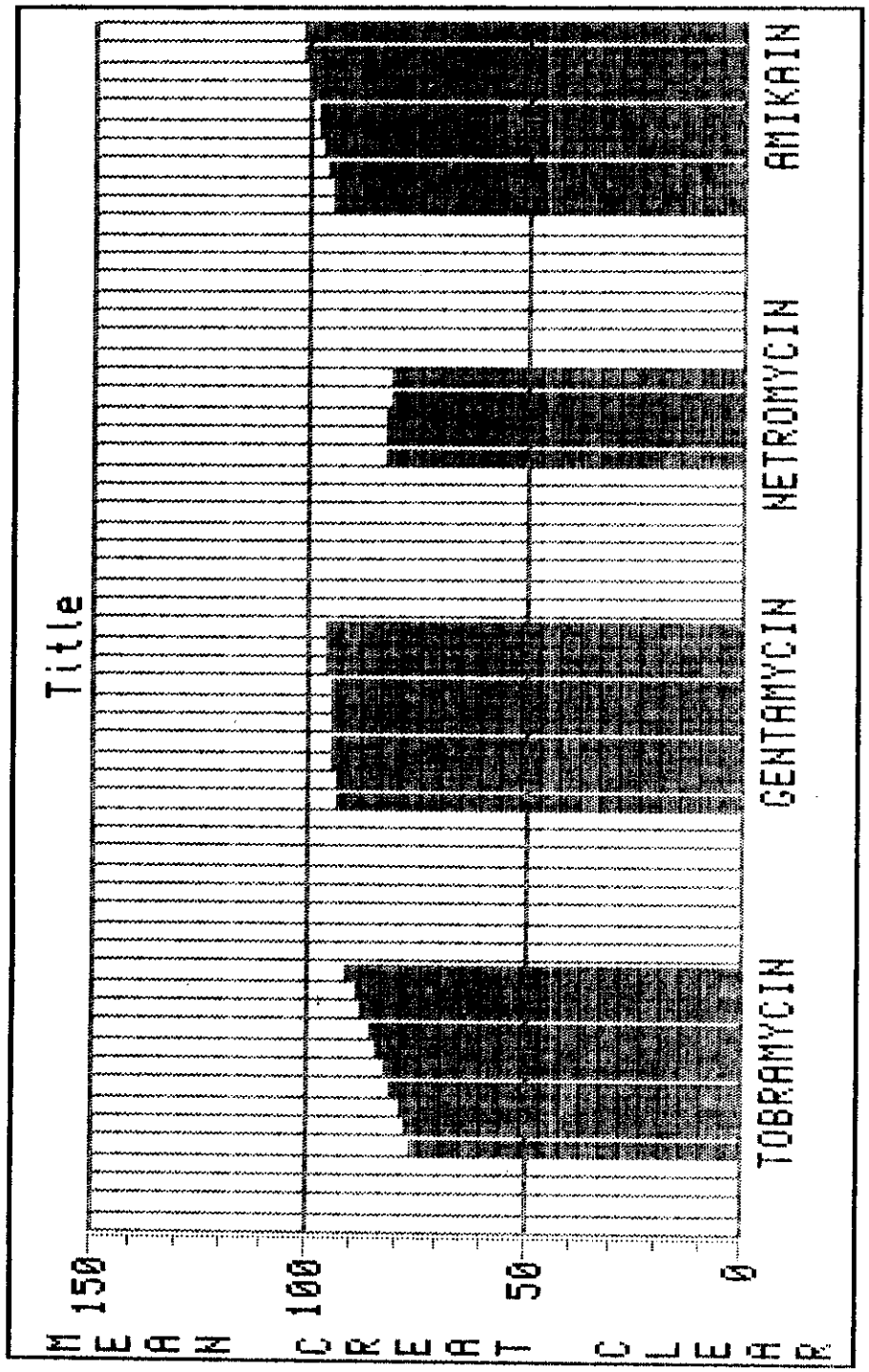
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