THE IMPACT OF OCCLUSIONS ON DOSE ACCURACY

3 Syringe Pumps

Model	OrchesTA Model 100	Baxter AS50	Harvard Apparatus PHD2000
Stated Accuracy	±3%*	±3%*	±0.35%*

* All excluding syringe variability

DISCLAIMER:
Instech sells OrchesTA and Harvard Apparatus pumps. The Baxter AS50 is discontinued.

Occlusions in Infusion Studies

INSTECH

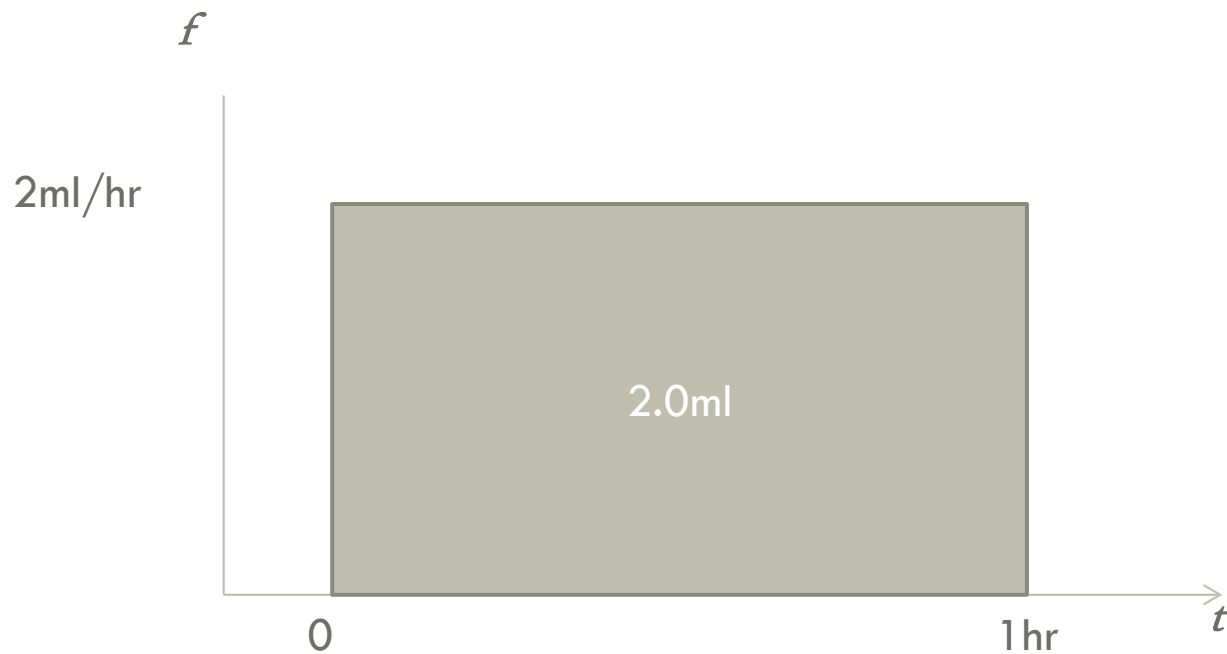Forgot to open pinch clamp
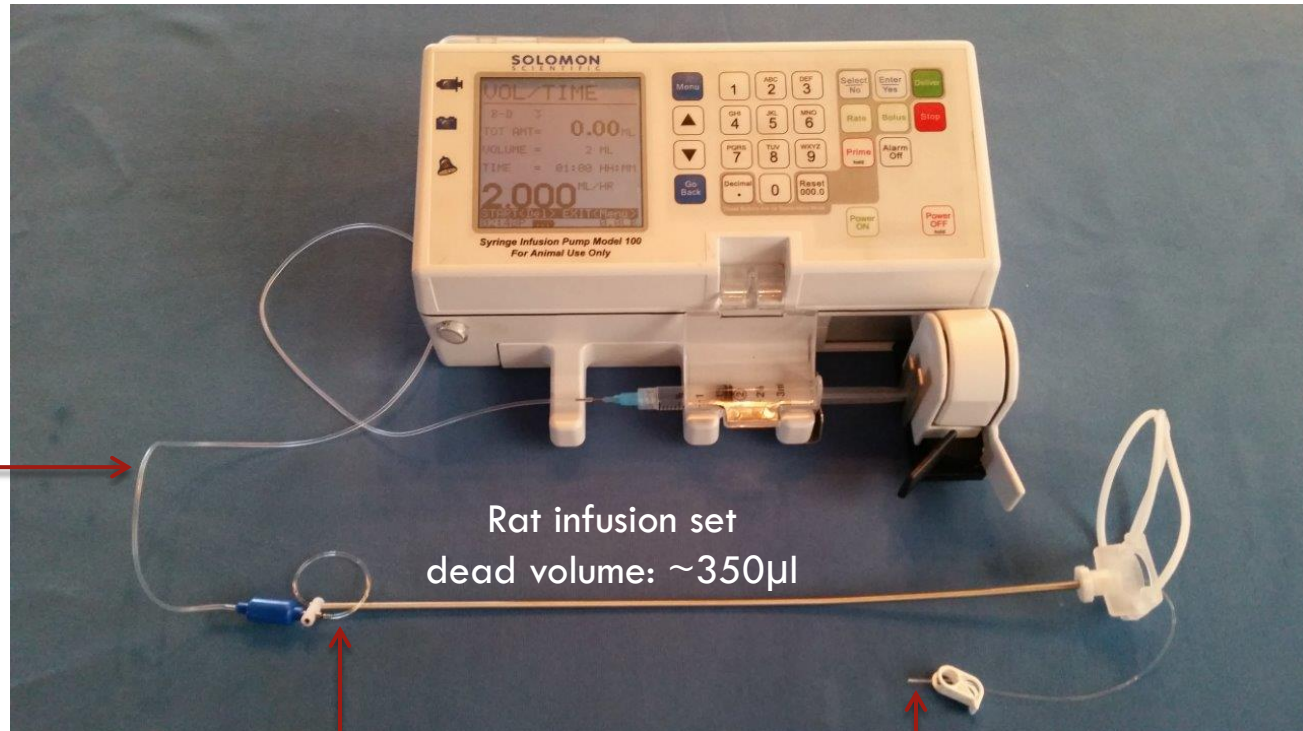
Rat infusion set dead volume: ~350µl
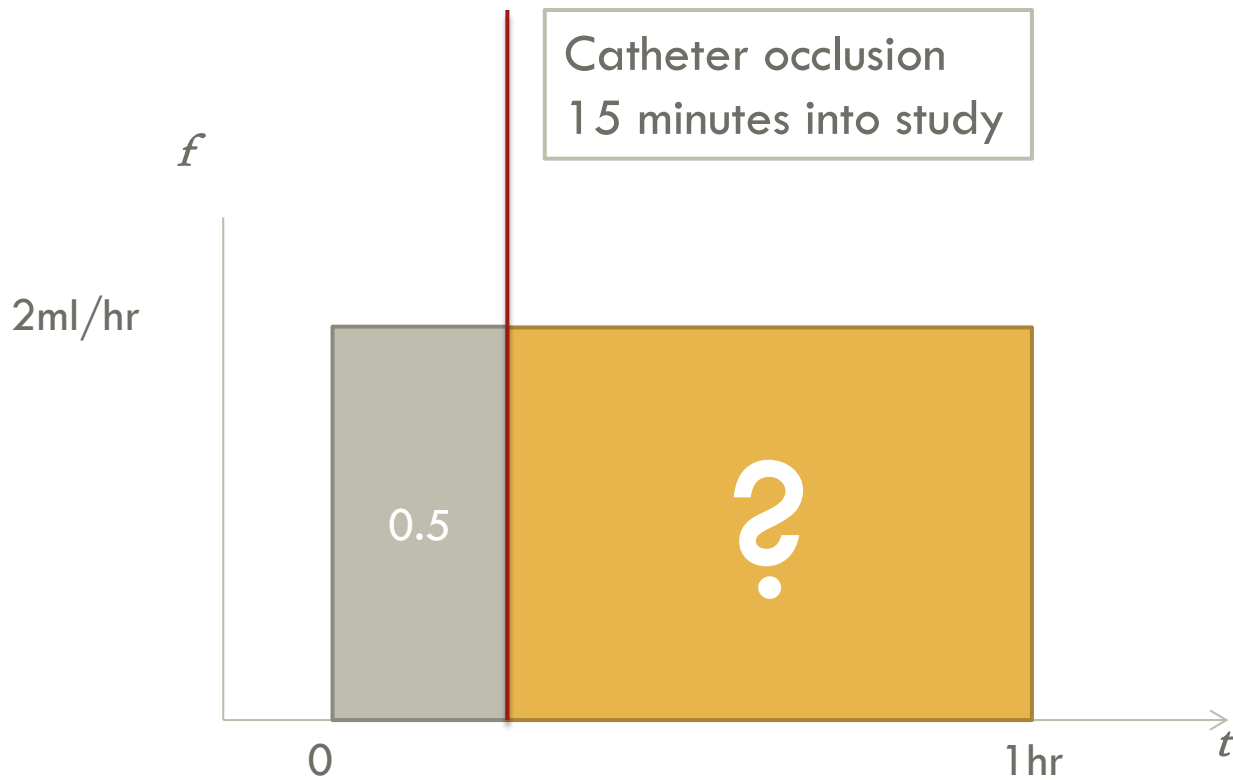
Kink in external tube

Kink in catheter or tip occlusion

What Can Happen?

PLANNED DOSE

3ml BD plastic syringe

What Can Happen?

Catheter occlusion
15 minutes into study

f

2ml/hr

0.5

?

0

1hr

t

What Can Happen?

Catheter occlusion
15 minutes into study
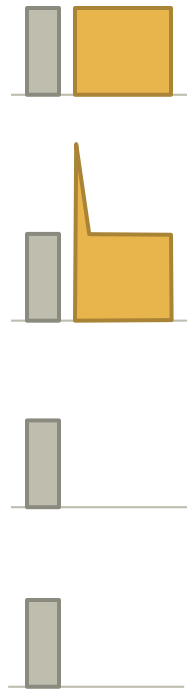
Scenario	ml into animal	ml left in syringe
Alarm, back off, fix, restart	2.0	0.0
Alarm, fix, bolus, restart	2.0	0.0
No alarm, pressure build up	0.5	1.5
No alarm, **leak**	0.5	0.0

Results: OrchesTA Model 100

INSTECH

Scenario	Alarm after **18sec** Auto back off Fix occlusion Restart
Vol. dispensed (error)	1.97ml (-1.5%)
Vol. delivered (error)	1.97ml (-1.5%)

Results: Baxter AS50
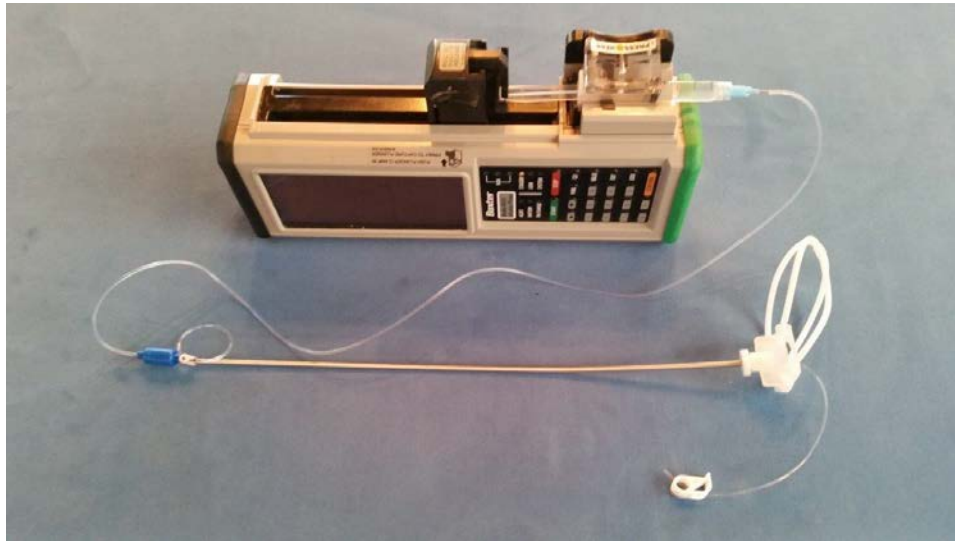
Scenario	Alarm after **2.0min** Manual back off Fix occlusion Restart
Vol. dispensed (error)	1.59ml (-20%)
Vol. delivered (error)	1.59ml (-20%)

Results: Harvard PHD2000

INSTECH
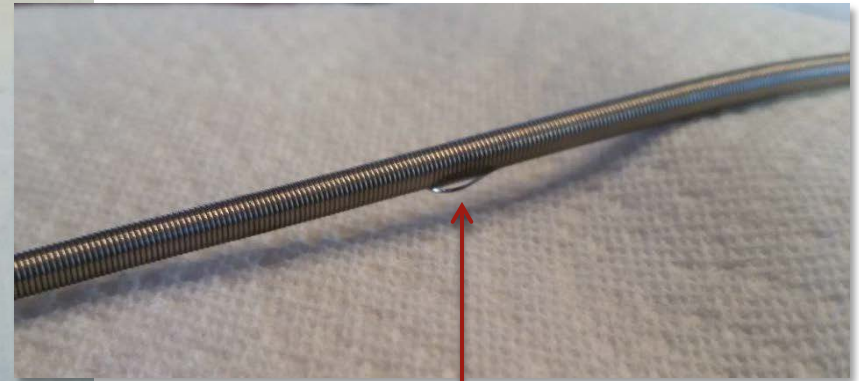
Leak

Scenario	No alarm **Leak** after 50min
Vol. dispensed (error)	1.95ml (-2.3%)
Vol. delivered (error)	0.5ml (-75%)

Summary

Model	OrchesTA Model 100	Baxter AS50	Harvard Apparatus PHD2000
Occlusion Sensor	In-line force transducer	Motor current monitor	None
Time to alarm	18sec	120sec	n/a
Dose Error	-1.5%	-20%	-75%
Reporting Error*	0%	0%	-75%

* If syringes are weighed to confirm every dose. Does not include weighing error.

BACKUP DATA FOR "IMPACT OF OCCLUSIONS ON DOSE ACCURACY"
Presentation by Jeffrey Sommers (Instech Laboratories) at ITO Conference in Cologne Germany, 7 September 2015

Experiment Parameters

Intended dose:	2.0ml infusion over 1hr
Equipment used:	Pump, plastic syringe (3 or 20ml), Instech KVAH95T rat tether kit, VAH95AB rat harness, 15cm 3Fr PU catheter
Occlusion simulation:	Catheter tip occluded at 15min (after 0.5ml infused) with pinch clamp. On occlusion alarm, follow pump operating manual to relieve pressure; undo pinch clamp; restart.

Results

PUMP	SYRINGE	OCCLUSION SETTING		TIME TO SENSE OCCLUSION (MIN)	SYRINGE WEIGHT (g) START	END	CHANGE	DISPENSE ERROR	LEAK?	DOSE ERROR
OrchesTA model 100	B-D 3ml	normal	Trial 1:	0.3	5.93	3.95	1.98	-1.0%	no	-1.0%
			Trial 2:	0.3	5.86	3.90	1.96	-2.0%	no	-2.0%
			Trial 3:	0.3	5.77	3.80	1.97	-1.5%	no	-1.5%
			Average:	0.3			1.97	-1.5%		**-1.5%**
Medfusion 2001	B-D 3ml	medium	Trial 1:	1.2	6.25	4.43	1.82	-9.0%	no	-9.0%
			Trial 2:	1.2	6.40	4.60	1.80	-10.0%	no	-10.0%
			Trial 3:	1.2	6.32	4.53	1.79	-10.5%	no	-10.5%
			Average:	1.2			1.80	-9.8%		**-9.8%**
SAI 3D	B-D 3ml	medium	Trial 1:	2.1	6.40	4.60	1.80	-10.0%	no	-10.0%
			Trial 2:	2.1	6.05	4.27	1.78	-11.0%	no	-11.0%
			Trial 3:	2.1	6.31	4.52	1.79	-10.5%	no	-10.5%
			Average:	2.1			1.79	-10.5%		**-10.5%**
Baxter AS50	B-D 3ml	medium	Trial 1:	2.1	5.75	4.18	1.57	-21.5%	no	-21.5%
			Trial 2:	1.8	6.05	4.42	1.63	-18.5%	no	-18.5%
			Trial 3:	2.1	5.91	4.33	1.58	-21.0%	no	-21.0%
			Average:	2.0			1.59	-20.3%		**-20.3%**
Harvard PHD2000	B-D 3ml	n/a	Trial 1:	n/a	6.03	4.09	1.94	-3.0%	yes @ 48min	-75%
			Trial 2:	n/a	6.11	4.15	1.96	-2.0%	yes @ 54min	-75%
			Trial 3:	n/a	5.85	3.89	1.96	-2.0%	yes @ 48min	-75%
			Average:				1.95	-2.3%		**-75%**
Harvard 11 Elite	B-D 3ml	1% (force limit)	Trial 1:	did not alarm	6.22	4.26	1.96	-2.0%	yes @ 48min	-75%
			Trial 2:	did not alarm	5.99	4.02	1.97	-1.5%	yes @ 54min	-75%
			Trial 3:	did not alarm	5.88	3.92	1.96	-2.0%	yes @ 50min	-75%
			Average:				1.96	-1.8%		**-75%**
OrchesTA model 100	B-D 20ml	normal	Trial 1:	11.0	28.57	26.78	1.79	-10.5%	no	-10.5%
			Trial 2:	11.0	26.78	24.97	1.81	-9.5%	no	-9.5%
			Trial 3:	11.0	24.97	23.17	1.80	-10.0%	no	-10.0%
			Average:	11.0			1.80	-10.0%		**-10.0%**
Medfusion 2001	B-D 20ml	medium	Trial 1:	13.2	23.15	21.57	1.58	-21.0%	no	-21.0%
			Trial 2:	14.4	21.57	20.01	1.56	-22.0%	no	-22.0%
			Trial 3:	14.7	20.01	18.42	1.59	-20.5%	no	-20.5%
			Average:	14.1			1.58	-21.2%		**-21.2%**
Baxter AS50	B-D 20ml	medium	Trial 1:	15.0	26.97	25.96	1.01	-49.5%	no	-49.5%
			Trial 2:	15.0	25.96	24.99	0.97	-51.5%	no	-51.5%
			Trial 3:	15.0	24.99	23.89	1.10	-45.0%	no	-45.0%
			Average:	15.0			1.03	-48.7%		**-48.7%**
SAI 3D	B-D 20ml	medium	Trial 1:	23.0	29.54	28.79	0.75	-62.5%	no	-62.5%
			Trial 2:	22.5	28.79	27.90	0.89	-55.5%	no	-55.5%
			Trial 3:	21.6	27.90	27.28	0.62	-69.0%	no	-69.0%
			Average:	22.4			0.75	-62.3%		**-62.3%**

DOSE ERROR, 3ML SYRINGE